

984 f  
G658

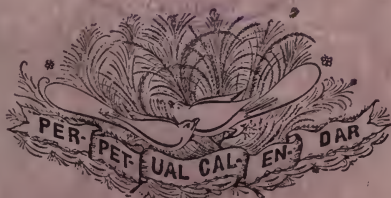
A COMPANION CO-ETERNAL WITH LIFE

UC-NRLF

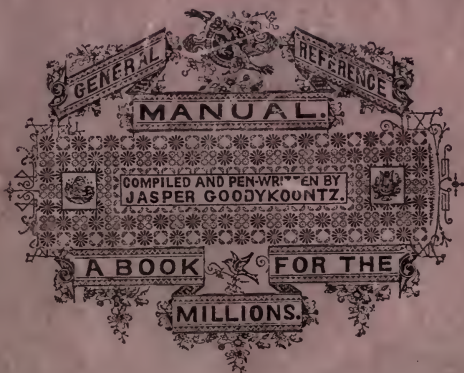


\$B 28 610

GOODYKONTZ'S



AND



Science and Art are twin sisters, and walk hand in hand.

YC 15460

# Sample Book

NOT TO BE TAKEN FROM  
THIS OFFICE

No. 46727

THE HICKS-JUDD CO.

LIBRARY  
OF THE  
UNIVERSITY OF CALIFORNIA.  
GIFT OF

*Hicks-Judd Co.*

Received *Mar.* 1898.

Accession No. *69809*

Class No.

*984f*  
*9658*

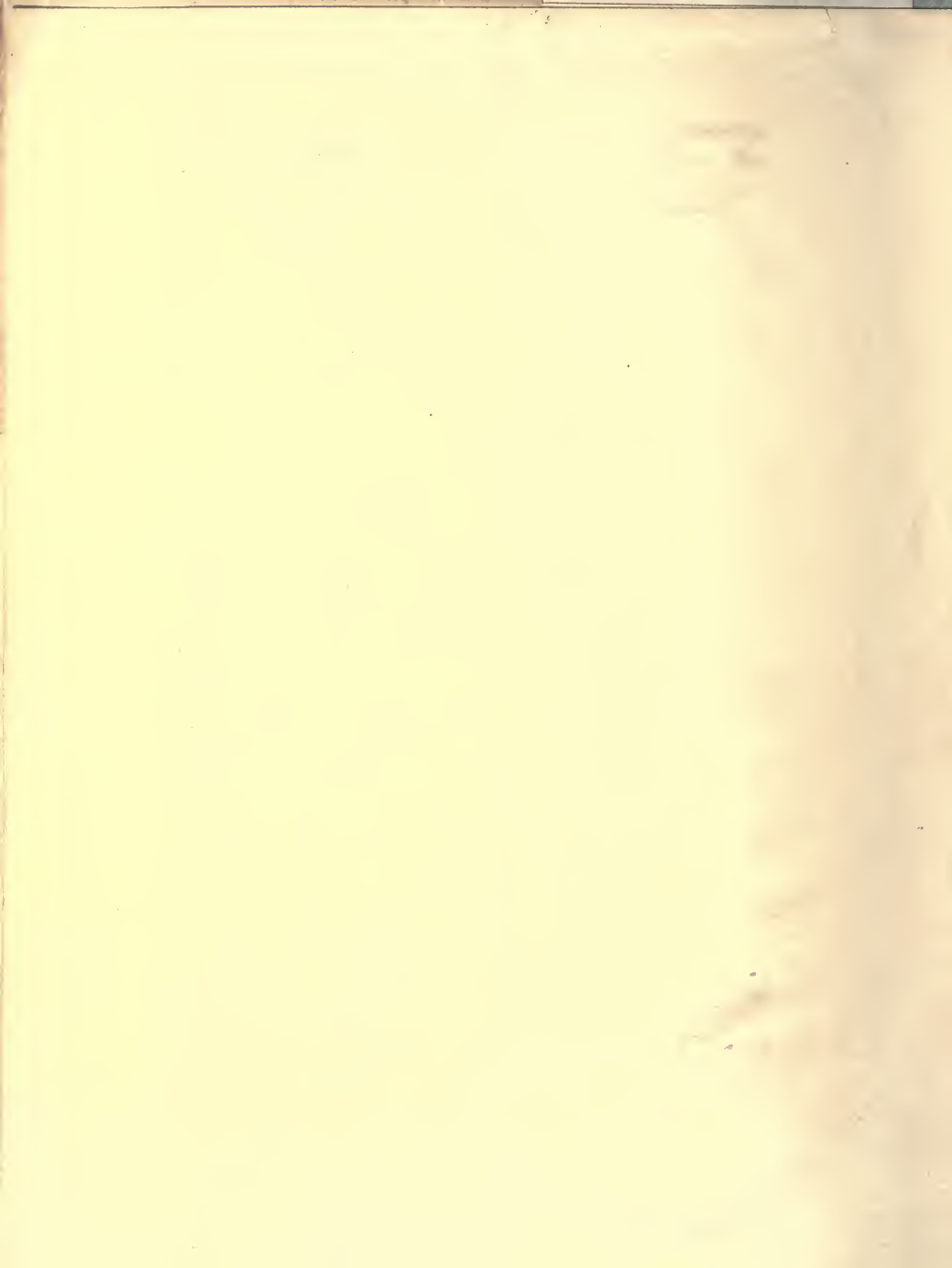
With Compliments of the Author.

# PERPETUAL CALENDAR.

PRESERVE FOR FUTURE REFERENCE.

CENTURY. SUNDAYS. CENTURY.

MONTHLY TABLES.											
S	M	T	W	T	F	S					
1	2	3	4	5	6	7	17th	18th	19th	A	
8	9	10	11	12	13	14	YEAR.	YEAR.	YEAR.	Jan.	
15	16	17	18	19	20	21	1601 to 1700.	1701 to 1800.	1801 to 1900.	Feb.	
22	23	24	25	26	27	28				Mar.	
29	30	31	1	2	3	4				April.	
5	6	7	8	9	10	11				May.	
12	13	14	15	16	17	18				June.	
19	20	21	22	23	24	25				July.	
26	27	28	29	30	31	1				Aug.	
2	3	4	5	6	7	8				Sept.	
9	10	11	12	13	14	15				Oct.	
16	17	18	19	20	21	22				Nov.	
23	24	25	26	27	28	29				Dec.	
30	31	1	2	3	4	5					
6	7	8	9	10	11	12					
13	14	15	16	17	18	19					
20	21	22	23	24	25	26					
27	28	29	30	31	1	2					
3	4	5	6	7	8	9					
10	11	12	13	14	15	16					
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	1	2	3	4	5	6					
7	8	9	10	11	12	13					
14	15	16	17	18	19	20					
21	22	23	24	25	26	27					
28	29	30	31	1	2	3					
9	10	11	12	13	14	15					
16	17	18	19	20	21	22					
23	24	25	26	27	28	29					
30	31	1	2	3	4	5					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31	1	2	3	4					
5	6	7	8	9	10	11					
12	13	14	15	16	17	18					
19	20	21	22	23	24	25					
26	27	28	29	30	31	1					
2	3	4	5	6	7	8					
9	10	11	12	13	14	15					
16	17	18	19	20	21	22					
23	24	25	26	27	28	29					
30	31	1	2	3	4	5					
6	7	8	9	10	11	12					
13	14	15	16	17	18	19					
20	21	22	23	24	25	26					
27	28	29	30	31	1	2					
3	4	5	6	7	8	9					
10	11	12	13	14	15	16					
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	1	2	3	4	5	6					
7	8	9	10	11	12	13					
14	15	16	17	18	19	20					
21	22	23	24	25	26	27					
28	29	30	31	1	2	3					
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30	31					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31	1	2	3	4					
5	6	7	8	9	10	11					
12	13	14	15	16	17	18					
19	20	21	22	23	24	25					
26	27	28	29	30	31	1					
2	3	4	5	6	7	8					
9	10	11	12	13	14	15					
16	17	18	19	20	21	22					
23	24	25	26	27	28	29					
30	31	1	2	3	4	5					
6	7	8	9	10	11	12					
13	14	15	16	17	18	19					
20	21	22	23	24	25	26					
27	28	29	30	31	1	2					
3	4	5	6	7	8	9					
10	11	12	13	14	15	16					
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	1	2	3	4	5	6					
7	8	9	10	11	12	13					
14	15	16	17	18	19	20					
21	22	23	24	25	26	27					
28	29	30	31	1	2	3					
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30	31					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31	1	2	3	4					
5	6	7	8	9	10	11					
12	13	14	15	16	17	18					
19	20	21	22	23	24	25					
26	27	28	29	30	31	1					
2	3	4	5	6	7	8					
9	10	11	12	13	14	15					
16	17	18	19	20	21	22					
23	24	25	26	27	28	29					
30	31	1	2	3	4	5					
6	7	8	9	10	11	12					
13	14	15	16	17	18	19					
20	21	22	23	24	25	26					
27	28	29	30	31	1	2					
3	4	5	6	7	8	9					
10	11	12	13	14	15	16					
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	1	2	3	4	5	6					
7	8	9	10	11	12	13					
14	15	16	17	18	19	20					
21	22	23	24	25	26	27					
28	29	30	31	1	2	3					
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30	31					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31	1	2	3	4					
5	6	7	8	9	10	11					
12	13	14	15	16	17	18					
19	20	21	22	23	24	25					
26	27	28	29	30	31	1					
2	3	4	5	6	7	8					
9	10	11	12	13	14	15					
16	17	18	19	20	21	22					
23	24	25	26	27	28	29					
30	31	1	2	3	4	5					
6	7	8	9	10	11	12					
13	14	15	16	17	18	19					
20	21	22	23	24	25	26					
27	28	29	30	31	1	2					
3	4	5	6	7	8	9					
10	11	12	13	14	15	16					
17	18	19	20	21	22	23					
24	25	26	27	28	29	30					
31	1	2	3	4	5	6					
7	8	9	10	11	12	13					
14	15	16	17	18	19	20					
21	22	23	24	25	26	27					
28	29	30	31	1	2	3					
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30	31					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31	1	2	3	4					
5	6	7	8	9	10	11					
12	13	14	15	16	17	18					
19	20	21	22	23	24	25					
26	27	28	29	30	31	1					
2											









Jasper Woodyhookey.

GOODYKOONTZ'S



AND

GENERAL

REFERENCE

MANUAL.

COMPILED AND PEN-WRITTEN BY  
JASPER GOODYKOONTZ.

A BOOK

FOR THE

MILLIONS.

Published by J. GOODYKOONTZ, New York.

Price 50 Cents.—Trade supplied by the American News Co., New York, or the Bancroft Co., San Francisco, Cal.

[1894]



# INDEX.

69809

	Page.
Album Writers' Department .....	24
American Wars and Battles .....	32
Annual Temperature, Mean .....	22
Average Annual Rainfall .....	22
Biographical Dictionary .....	78
Business Arithmetic .....	34
Business Correspondence .....	30
Business Time Tables .....	14
Cemetery, In the .....	26
Circumnavigators of Globe .....	80
Comparative Distances of Planets .....	11
Comparative Sizes of Planets .....	11
Comparative Size of Sun as seen from Planets .....	11
Compound Interest Tables .....	16
Declination of Sun .....	10
Dictionary of Business Arithmetic .....	34
Distances, Table of .....	22
Easter Sunday Table for 600 years .....	8
Eclipses .....	11
Equinoxes .....	11
Epacts for 30 years .....	23
Epitaphs, Classified list of .....	27
Eras Compared .....	8
Fixed Festivals .....	8
Fractional Multiplication Table .....	20
Geography of the Heavens .....	86
Holidays .....	8
Interest Table, Instantaneous .....	18
Jewish Calendar .....	12
Local Time Chart .....	9
Lumber Measure, Instantaneous Method .....	28
Map of World .....	9
Mensuration .....	46
Mohammedan Calendar .....	13
Months, History of .....	3
Movable Festivals .....	8
Notes on Calendar .....	7
Notes on Eras .....	8
Perpetual Calendar .....	4
Perpetual Moonlight Chart .....	23
Perpetual Sunset and Sunrise Table .....	10
Phases of Moon .....	23
Pilgrim Fathers .....	80
Planets .....	11
Seasons, Theory of .....	11
Signs of the Zodiac .....	10
Solar System .....	11
Sun, Slow or Fast .....	10
Sunset and Sunrise .....	10
Tides, Theory of .....	11
Twilight Table .....	21
Velocities, Table of .....	88
Weather Wisdom .....	21
Weights and Measures, Dictionary of .....	58



# GOODYKOONTZ'S AND GENERAL PERPETUAL CALENDAR REFERENCE MANUAL.

PHOTO ENGRAVED FROM PEN COPY MADE BY THE AUTHOR.

## JANUARY

January is named from the Roman *Janus*, who was the Porter of heaven. He presided over the beginning or opening of everything, hence, the first month of the year was named after him. January was added to the list of months by Numa Pompilius, 672 B.C. Among the Romans, on the first of this month all enemies were suspended, presents were exchanged, officers were installed, etc. Thus ancient was the origin of New Year's.

## FEBRUARY

February is derived from *Februus*, the Roman festival of general expiation and lustration, which was celebrated during the latter part of this month. It was added to the list of months by Numa, 672 B.C. Every fourth year February has 29 days instead of 28, and such years are called "bissexile" or "leap years." In this month the Lupercalia were held among the Romans. It is the month of harvest in Upper Egypt.

## MARCH

March is named from *Mars*, the Roman god of war. It was the first month in the early calendar, and the legal year began with March 25th until the change from Old to New Style in the year 1752. The value of March weather is expressed in the sayings, "A peck of March dust is worth a king's ransom," "March comes in like a lion, and goes out like a lamb." Harvest month in India.

## APRIL

The derivation of April is unknown, yet there is a traditional etymology, *antra aperit*, "it opens everything," as spring and the buds generally open in this month. All-Fools' Day (April 1) is traced through every country of Europe to the Hindus, and even farther back to the mistake of Noah in sending the dove out of the ark before the water had abated, on the Hebrew first day of the month.

## MAY

May is probably derived from *Maia*, a feminine divinity worshipped at Rome, to whom sacrifices were offered on the first day of May. The custom of observing May-day, or the first day of May, with floral and festive ceremonies, is older than the Middle Ages. The May-Pole was once general in England, the young people going out before sunrise to gather flowers to adorn it.

## JUNE

June has commonly been traced to *Juno*, worshipped at Rome as the queen of heaven. The connection is found in the fact that the month of June was considered the most favorable period for marrying, and Juno was believed to preside over marriage. The summer solstice occurs in this month, and in the north temperate zone it is the most pleasant month of the year. Harvest month in South U.S.

## JULY

July derives its name from *Julius Caesar*, who was born on the 12th of the month. It was originally called *Quintilis*, from its having been the fifth month in the original Latin year, which began with March. This is the month of "dog days," reckoned as commencing on the 3d, and ending on the 11th of August, during which period the extreme heat of summer prevails. Harvest month in most countries in Northern Hemisphere.

## AUGUST

August owes its name to *Augustus Caesar*, who followed his illustrious predecessor by appropriating a month to himself. In the original Latin year it was called *Sextilis*, from its being the sixth month. It originally contained 30 days, but to gratify the vanity of Augustus, one day was taken from February and added to August, so as to make his month equal in extent and dignity to the month of Julius Caesar—July.

## SEPTEMBER

September is so called from the Latin *Septem*, seven, because it was the 7th month of the Roman year. This is the harvest month throughout large areas of the globe. Harvest moon is the full moon nearest the autumnal equinox (Sept. 21), so called because it enables farmers to prolong the day's work during the autumnal harvest, especially favorable in the north.

## OCTOBER

October was the eighth month of the Roman calendar, which has given rise to the following: "October has its name from *octo*, eight. Though 'tis the truth, perhaps 'tis well to state, Such sixes and such sevens the months were knocked to That ten became translated into *octo*." The changing of the forests to the gorgeous and many-colored hues of autumn is characteristic of October.

## NOVEMBER

November was formerly the ninth month, now the eleventh. From *novem*, nine. This month is redeemed almost every year from its cold and bustling character, by the delightful weather known as Indian Summer, when for days or weeks the sun pours its rays mildly through a haze, rendering the air soft and genial. This month is also noted for its time-honored festival known as Thanksgiving.

## DECEMBER

December is derived from *decem*, ten, as it was formerly the tenth month. The longest nights and shortest days occur during this month, the winter solstice falling on the 21st. As the month of the Christmas holidays, which time from Decem. 24 to Jan. 2, its cold winds and gloomy atmosphere are enlivened with the joyousness and charity of the greatest festival in the year.

## YEAR-DAY

The Year is the period of time in which the earth performs a revolution in its orbit around the sun. It consists of 365 days 5 hours 48 minutes, and 46 seconds of mean solar time. The Day is the interval of time which elapses between two consecutive returns of the same terrestrial meridian to the sun. The Week is a period of seven days, having no reference to the celestial motions—a circumstance to which it owes its unalterable uniformity.

## WEEK SEE ABOVE



A CALENDAR FOR ALL PEOPLE AND FOR ALL TIME.

# GOODYKOONTZ'S PERPETUAL CALENDAR

An instantaneous reference calendar from which the complete and correct calendar for any year, either old or new style, before or after Christ, may be instantly found.

COPYRIGHT, 1892 AND 1893, BY JASPER GOODYKOONTZ.

PHOTO-ENGRAVED FROM PEN COPY MADE BY THE AUTHOR.

## YEARS OF THE CENTURIES.

A	B	C	D	E	F	G
OS. 1400 • 3A	OS. 1600 • 3A	OS. 1800 • 1A	OS. 1900 • 7A	OS. 1700 • 2A	OS. 1500 • 4A	OS. 1300 • 6A
N.S. 1700 • 6	N.S. 1800 • 4	N.S. 1900 • 2	N.S. 2000 • 7A			
1 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

### OBSERVATIONS AND EXAMPLES.

To find the calendar for any year, look in the column of centuries at the left for the required century, at the right of which is the Century Letter for New Style (Since Sept. 3, 1752), and at the left, the Century Letter for Old Style. These letters direct to corresponding letters at the top of the double columns, in which are given the years of the centuries. A & the right of each year in the double column is the Calendar Number, directing to the corresponding number of the calendars which follow. All the years of 1800 are given in the second double column under B; all the years of 1900, in the third double column, etc.

- 1.—Find the calendar for 1894.—Look in the column of centuries for 1800; at its right is B, directing to B at the top of the second double column; at the right of 94 in this column is A, directing to Calendar Number 2, which is the correct calendar for 1894.
- 2.—On what day was Washington inaugurated President, April 30, 1897? As the right of 1900 (in century column) is A; under A in the first double column, at the right of 99 is 5; in calendar number 5 April 30th is Thursday.
- 3.—On what day did Columbus discover America, October 12, 1492?—At the left of 1400 (Old Style) is A; under A at the right of 92 is 1A; in calendar number 1A the 12th of October is Friday.
- 4.—On what day was Christ born, April 5th of the year 4 B.C.?—The years B.C. being reckoned backward, it is necessary to take the year of the century from 100, and use the century letter of the preceding century; thus, 4 (year of century) from 100 leaves 96; century letter for 100 (New Style) is C; under C in the third double column at the right of 96 is 2A; in calendar number 2A the 5th of April is Friday.
- 5.—Assuming that time has been reckoned according to the present system, on what day did Noah's deluge begin, Dec. 7, 2348 B.C.?—48 from 100 leaves 52; century letter for 2400 (preceding century) is D; calendar number for 52 under D is 2A; the 7th of December was Saturday.

See at the close of calendar number 1A.



CALENDAR NUMBER 12 CALENDAR NUMBER 23 CALENDAR NUMBER 34 CALENDAR NUMBER 45. CALENDAR NUMBER 5

# 6 CALENDAR NUMBER 6

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
FEB.	1	2	3	4	5	6	7	MAY	1	2	3	4	5	6	7	AUG.	1	2	3	4	5	6	7	NOV.	1	2	3	4	5	6	7
MAR.	8	9	10	11	12	13	14	JUNE	8	9	10	11	12	13	14	SEPT.	8	9	10	11	12	13	14	DEC.	8	9	10	11	12	13	14

# 7 CALENDAR NUMBER 7

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
FEB.	1	2	3	4	5	6	7	MAY	1	2	3	4	5	6	7	AUG.	1	2	3	4	5	6	7	NOV.	1	2	3	4	5	6	7
MAR.	8	9	10	11	12	13	14	JUNE	8	9	10	11	12	13	14	SEPT.	8	9	10	11	12	13	14	DEC.	8	9	10	11	12	13	14

# 1A CALENDAR NUMBER 1A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
FEB.	1	2	3	4	5	6	7	MAY	1	2	3	4	5	6	7	AUG.	1	2	3	4	5	6	7	NOV.	1	2	3	4	5	6	7
MAR.	8	9	10	11	12	13	14	JUNE	8	9	10	11	12	13	14	SEPT.	8	9	10	11	12	13	14	DEC.	8	9	10	11	12	13	14

# 2A CALENDAR NUMBER 2A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
FEB.	1	2	3	4	5	6	7	MAY	1	2	3	4	5	6	7	AUG.	1	2	3	4	5	6	7	NOV.	1	2	3	4	5	6	7
MAR.	8	9	10	11	12	13	14	JUNE	8	9	10	11	12	13	14	SEPT.	8	9	10	11	12	13	14	DEC.	8	9	10	11	12	13	14

# 3A CALENDAR NUMBER 3A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
FEB.	1	2	3	4	5	6	7	MAY	1	2	3	4	5	6	7	AUG.	1	2	3	4	5	6	7	NOV.	1	2	3	4	5	6	7
MAR.	8	9	10	11	12	13	14	JUNE	8	9	10	11	12	13	14	SEPT.	8	9	10	11	12	13	14	DEC.	8	9	10	11	12	13	14



JAN.	2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523
------	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S	
1	4	11	18	25				1	4	11	18	25				1	4	11	18	25				1	4	11	18	25				
2	9	16	23					2	9	16	23					2	9	16	23					2	9	16	23					
3	10	17	24					3	10	17	24					3	10	17	24					3	10	17	24					
4	12	19	26					4	12	19	26					4	12	19	26					4	12	19	26					
5	13	20	27					5	13	20	27					5	13	20	27					5	13	20	27					
6	14	21	28					6	14	21	28					6	14	21	28					6	14	21	28					
7	15	22	29					7	15	22	29					7	15	22	29					7	15	22	29					
8	16	23	30					8	16	23	30					8	16	23	30					8	16	23	30					
9	17	24	31					9	17	24	31					9	17	24	31					9	17	24	31					
10	18	25						10	18	25						10	18	25						10	18	25						
11	19	26						11	19	26						11	19	26						11	19	26						
12	20	27						12	20	27						12	20	27						12	20	27						
13	21	28						13	21	28						13	21	28						13	21	28						
14	22	29						14	22	29						14	22	29						14	22	29						
15	23	30						15	23	30						15	23	30						15	23	30						
16	24	31						16	24	31						16	24	31						16	24	31						
17	25							17	25							17	25							17	25							
18	26							18	26							18	26							18	26							
19	27							19	27							19	27							19	27							
20	28							20	28							20	28							20	28							
21	29							21	29							21	29							21	29							
22	30							22	30							22	30							22	30							
23	31							23	31							23	31							23	31							
24								24								24								24								
25								25								25								25								
26								26								26								26								
27								27								27								27								
28								28								28								28								
29								29								29								29								
30								30								30								30								
31								31								31								31								
32								32								32								32								
33								33								33								33								
34								34								34								34								
35								35								35								35								
36								36								36								36								
37								37								37								37								
38								38								38								38								
39								39								39								39								
40								40								40								40								
41								41								41								41								
42								42								42								42								
43								43								43								43								
44								44								44								44								
45								45								45								45								
46								46								46								46								
47								47								47								47								
48								48								48								48								
49								49								49								49								
50								50								50								50								
51								51								51								51								
52								52								52								52								
53								53								53								53								
54								54								54								54								
55								55								55								55								
56								56								56								56								
57								57								57								57								
58								58								58								58								
59								59								59								59								
60								60								60								60								
61								61								61								61								
62								62								62								62								
63								63								63								63								
64								64								64								64								
65								65								65								65								
66								66								66								66								
67								67								67								67								
68								68								68								68								
69								69								69								69								
70								70								70								70								
71								71								71								71								
72								72								72								72								
73								73								73								73								
74								74								74								74								
75								75								75								75								
76								76								76								76								
77								77								77								77								
78								78								78								78								
79								79								79								79								
80								80																								

JAN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	JULY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	AUG.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SEPT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	OCT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	NOV.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	DEC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

JAN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FEB.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
MAR.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JULY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
AUG.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
SEPT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
OCT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
NOV.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
DEC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

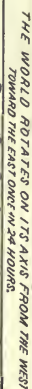
The calendar for any year may be found within the limit of six seconds.

# ERAS COMPARED.

CENTURIES OF DECLINATION OF INDEPENDENCE OF U.S.A.	CENTURIES OF THE JEWISH ERA.	CENTURIES OF THE MUNDANE ERA (Jewish).	CENTURIES OF THE JULIAN PERIOD.	CENTURIES OF THE CHRISTIAN ERA.	CENTURY LETTERS NEW STYLE
1524	7061	7204	8013	3300	A
1424	6961	7204	7913	3200	D
1324	6861	7104	7813	3100	C
1224	6761	7004	7713	3000	B
1124	6661	6904	7613	2900	A
1024	6561	6804	7513	2800	D
924	6461	6704	7413	2700	C
824	6361	6604	7313	2600	B
724	6261	6504	7213	2500	A
624	6161	6404	7113	2400	D
524	6061	6304	7013	2300	C
424	5961	6204	6913	2200	B
324	5861	6104	6813	2100	A
224	5761	6004	6713	2000	D
124	5661	5904	6613	1900	C
24	5561	5804	6513	1800	B
...	5461	5704	6413	1700	A
...	5361	5604	6313	1600	D
...	5261	5504	6213	1500	C
...	5161	5404	6113	1400	B
...	5061	5304	6013	1300	A
...	4961	5204	5913	1200	D
...	4861	5104	5813	1100	C
...	4761	5004	5713	1000	B
...	4661	4904	5613	900	A
...	4561	4804	5513	800	D
...	4461	4704	5413	700	C
...	4361	4604	5313	600	B
...	4261	4504	5213	500	A
...	4161	4404	5113	400	D
...	4061	4304	5013	300	C
...	3961	4204	4913	200	B
...	3861	4104	4813	100	A
...	3761	4004	4713	0	D
...	3661	3904	4613	...	C
...	3561	3804	4513	...	B
...	3461	3704	4413	...	A
...	3361	3604	4313	...	D
...	3261	3504	4213	...	C
...	3161	3404	4113	...	B
...	3061	3304	4013	...	A
...	2961	3204	3913	...	D
...	2861	3104	3813	...	C
...	2761	3004	3713	...	B
...	2661	2904	3613	...	A
...	2561	2804	3513	...	D
...	2461	2704	3413	...	C
...	2361	2604	3313	...	B
...	2261	2504	3213	...	A
...	2161	2404	3113	...	D
...	2061	2304	3013	...	C
...	1961	2204	2913	...	B
...	1861	2104	2813	...	A
...	1761	2004	2713	...	D
...	1661	1904	2613	...	C
...	1561	1804	2513	...	B
...	1461	1704	2413	...	A
...	1361	1604	2313	...	D
...	1261	1504	2213	...	C
...	1161	1404	2113	...	B
...	1061	1304	2013	...	A
...	961	1204	1913	...	D
...	861	1104	1813	...	C
...	761	1004	1713	...	B
...	661	904	1613	...	A
...	561	804	1513	...	D
...	461	704	1413	...	C
...	361	604	1313	...	B
...	261	504	1213	...	A
...	161	404	1113	...	D
...	61	304	1013	...	C
...	1	204	913	...	B
...	...	104	813	...	A
...	...	4	713	...	D
...	...	...	613	...	C
...	...	...	513	...	B
...	...	...	413	...	A
...	...	...	313	...	D
...	...	...	213	...	C
...	...	...	113	...	B
...	...	...	13	...	A
...	...	...	1	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	C
...	...	...	...	...	B
...	...	...	...	...	A
...	...	...	...	...	D
...	...	...	...	...	



EACH MERIDIAN DRAWN ON THE MAP REPRESENTS  $15^{\circ}$  OF LONGITUDE, OR ONE HOUR OF TIME.



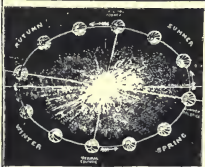
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24

180 165 150 135 120 105 90 (LONGITUDE) OF 45 (LONGITUDE) OF 60 (LONGITUDE) OF 75 (LONGITUDE) OF 90 (LONGITUDE) OF 105 (LONGITUDE) OF 120 (LONGITUDE) OF 135 (LONGITUDE) OF 150 (LONGITUDE) OF 165 (LONGITUDE) OF 180

TO USE THE CHART, DESCEND ON YOUR LOCAL MERIDIAN TO THE REQUIRED HOUR OF THE DAY OR NIGHT, THEN PASS TO THE RIGHT OR LEFT; THUS, WHEN IT IS 9 P.M. AT NEW YORK IT IS 10 A.M. IN THE WESTERN PART OF AUSTRALIA.

LONGITUDE EAST MEANS ADD TO LOCAL TIME. LONGITUDE WEST MEANS SUBTRACT FROM LOCAL TIME.

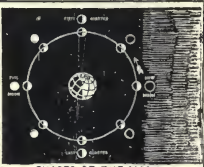




POSITION OF EARTH AT DIFFERENT SEASONS.

## Perpetual Sunset and Sunrise Table.

To find the time of sunset or sunrise for any day in any year, find the day of the month (or its nearest approximate) as given under the column of months at the right and left; then pass inward to the column headed by your latitude (or its nearest approximate) where will be found the time of sunset and sunrise. By approximation the exact time may be found. To find the length of the day, double the time of sunset; thus, May 20, in latitude 37°, is 14 hours 16 min. uses long. To find the length of the night, double the time of sunrise; thus, on the above date, the night is 9 hours 54 minutes long. On the same day, as shown by the columns between 30 and 33, the sun is 4 minutes less than mean time. After finding your latitude, draw a red line on each side of the column from top to bottom, so as to catch the eye at a glance.



PHASES OF THE MOON.

SUN SLOW OR FAST		MONTHS		SUN RISES AND SETS		LATITUDE		MONTHS		SUN SLOW OR FAST	
						COPYRIGHT, 1897, BY J. JESPER GOODENOUGH					

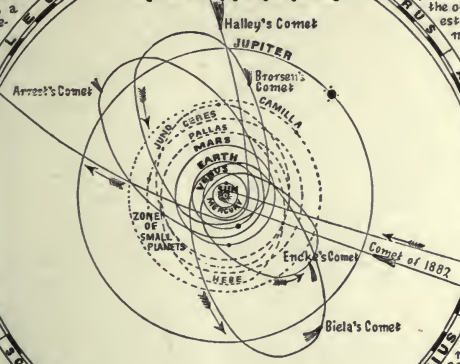


## THE SOLAR SYSTEM.

The Solar System consists of the Sun, the eight large planets, the names of which are given at the left, one hundred and forty small planets, a vast number of meteoric bodies, and an unknown number of comets, and a ring of nebulous matter known as the Zodiacal Light.

The planets which move directly around the Sun are called primary planets, those which move around their primaries are called secondary planets, also called moons or satellites. The Earth has 1 satellite; Jupiter, 4; Saturn, 8; Uranus, 6; Neptune, 1. Saturn is also surrounded by a circular belt. The planets move round the Sun from west to east. Their orbits are elliptical, so that they are nearer the Sun at certain times than at others. When nearest the Sun they are in perihelion; when farthest, in aphelion.

## THE SOLAR SYSTEM.

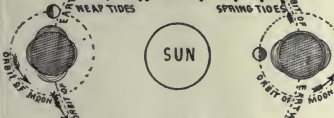


Due to their great distance the orbits of Venus and Neptune cannot be shown on this diagram.

## PHASES OF THE MOON.



## THEORY OF THE TIDES.



## THEORY OF

## THE SUN.

The mean distance of the Sun from the Earth is 91,000,000 miles. Its diameter is 852,584 miles. Its volume is 1,200,000 times greater than that of the Earth. It rotates on its axis once in about 25 days. On the Sun's disc are seen various cavities called sun-spots.

## METEORS.

Meteors are also called bolides or shooting stars. The number that traverse the atmosphere daily is upward of the number, 400,000,000. The Zodiacal Light is a lens-shaped bluish of light visible after sunset in early spring, and before sunrise in early autumn. It is supposed to be due to a ring of meteorites revolving around the Sun.

## THE ASTEROIDS.

Of the Asteroids or small planets, there are about 140. In dimensions, they are a great deal smaller than the others, the largest not being 230 miles in diameter, while many are less than 50 miles. Their orbits are more elliptical than those of the large planets, and at many places cross each other. They occupy a belt more than 200,000 miles in width, between the orbits of Jupiter and Mars, their distance from the Sun, ranging from 200,000,000 to 300,000,000 of miles.

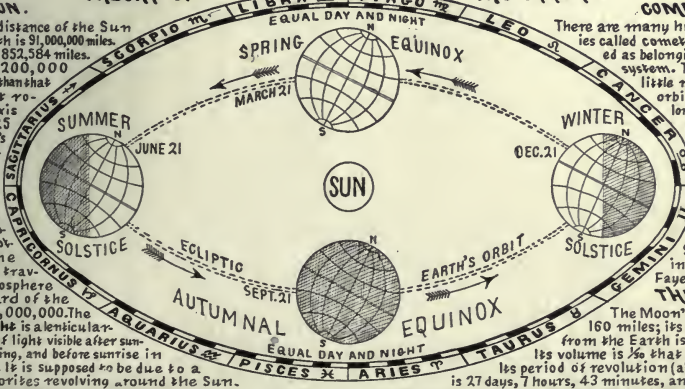
## THE PLANETS.

	DIAMETER	LENGTH OF YEAR	HOURLY MOTION
	MILES	DAYS	M. M. MILES.
MERCURY	2,962	88.24	5 105,000
VENUS	7,510	225.22	16 77,050
EARTH	7,920	365.24	0 65,822
MARS	4,920	687.24	37 32,000
JUPITER	87,170	4,332.9	35 26,744
SATURN	72,860	10,759.1	30 10,222
URANUS	32,024	30,687.9	14 3,962
NEPTUNE	36,620	60,127.1	11 3,958

## ECLIPSES.



## THE SEASONS.



## COMETS.

There are many hundreds of bodies called comets, and recognized as belonging to the solar system. They contain but little matter, and their orbits are greatly elongated. Only a part of the comets have tails, and these are often 150,000,000 of miles in length. Halley's comet revolves in 76 years; Biela's in 6 years; 9 months; Encke's in 3 1/2 years; and Faye's in 7 1/2 years.

## THE MOON.

The Moon's diameter is 2,160 miles; its mean distance from the Earth is 237,519 miles. Its volume is 1/80 that of the Earth. Its period of revolution (also of rotation) is 27 days, 7 hours, 43 minutes, and 5 seconds.



# JEWISH CALENDAR

The Jewish year is luni-solar, and is ordinarily of embolismic, consisting of twelve or thirteen lunar months, each of which has 29 or 30 days. The length of the ordinary year is 354 days, and of the embolismic, 384 days; in either case, it is sometimes made a day more or a day less, in order that certain festivals may fall on proper days of the week.

The distribution of the embolismic years is shown in each cycle of 19 years, is determined according to the following rules: The number of a Jewish year having its commencement in a Gregorian year is obtained by adding 3761; divide the Jewish year by 19; then the quotient is the number of the completed cycle, and the remainder is the year of the current cycle; if the remainder be 2, 5, 8, 11, 14, 17, or 19, the year is embolismic; if any other, the year is ordinary.

The calendar is constructed on the assumption that the mean length is 29 days 12 hours

14 minutes 29 seconds, and that the year commences on, or immediately after, the new moon following the autumnal equinox. The mean solar year is also assumed to be 365 days 5 hours 55 minutes 25 1/2 seconds, so that a cycle of nineteen such years, is the exact measure of 235 of the assumed lunations.

After the dates of the commencement of the successive years are adjusted, an estimation of the consecutive intervals, by taking the differences, will show the duration and character of the years that respectively intervene. According to the number of days thus found to be contained in the different years, the days of the several months are distributed as in the table of months. The signs and — are respectively annexed to HESVAN and KISLEV to indicate that the former of these months may sometimes require to be one day more or one day less, and the latter, one day less, than the number of days shown in the table, — the result, in every

case, being at once determined by the total number of days that the year may happen to contain.

## JEWISH MONTHS. PRINCIPAL DAYS OF THE HEBREW CALENDAR.

HEBREW MONTHS	ORDINARY MONTHS	EMBOLISMIC MONTHS	PRINCIPAL DAYS OF THE HEBREW CALENDAR
TISRI	30	30	1, New Year, Feast of Trumpets
HESVAN	29+	30	2, Fast of Gedaliah.
KISLEV	30—	30—	3, Fast of First of Fruits.
TEBAT	29	29	4, Fast of Tabernacles.
ADAR	29	30	5, 21, Last Day of the Festival.
VEADAR	(+)	(29)	6, 22, Feast of the 8th Day.
NISAN	30	30	7, 23, Rejoicing of the Law.
SIYAN	30	30	8, KISLEV 25, Dedication of Temple.
THAMUZ	29	29	9, 10, Feast of Weeks.
AB	30	30	11, 12, Feast of Weeks.
ELUL	29	29	13, 14, Feast of Weeks.

## TABLE OF HEBREW YEARS, (FROM WOOLHOUSE'S WEIGHTS, MEASURES, ETC.)

JEWISH YEAR	NUMBER OF DAYS	COMMENCEMENT (1ST OF TISRI)	JEWISH YEAR	NUMBER OF DAYS	COMMENCEMENT (1ST OF TISRI)	JEWISH YEAR	NUMBER OF DAYS	COMMENCEMENT (1ST OF TISRI)	JEWISH YEAR	NUMBER OF DAYS	COMMENCEMENT (1ST OF TISRI)
5600	354	THUR. 2 OCT. 1843	5663	355	THUR. 2 OCT. 1902	5726	355	SAT. 3 OCT. 1959	5789	354	MON. 3 OCT. 2016
07	355	MON. 21 SEPT. 1846	64	355	SAT. 22 SEPT. 1903	127	354	THUR. 22 SEPT. 1961	79	354	THUR. 21 SEPT. 2017
08	353	SAT. 11 SEPT. 1847	65	385	SAT. 10 SEPT. 1904	128	353	MON. 11 SEPT. 1962	80	353	MON. 10 SEPT. 2018
09	354	THUR. 28 SEPT. 1848	66	355	SAT. 30 SEPT. 1905	129	355	SAT. 29 SEPT. 1963	81	355	MON. 30 SEPT. 2019
10	355	MON. 17 SEPT. 1849	67	354	THUR. 20 SEPT. 1906	130	354	THUR. 19 SEPT. 1964	82	353	SAT. 19 SEPT. 2020
11	355	SAT. 7 SEPT. 1850	68	385	MON. 9 SEPT. 1907	131	385	MON. 7 SEPT. 1965	83	384	TUES. 7 SEPT. 2021
12	353	SAT. 27 SEPT. 1851	69	355	SAT. 26 SEPT. 1908	132	355	MON. 27 SEPT. 1966	84	355	MON. 26 SEPT. 2022
13	354	TUES. 14 SEPT. 1852	70	385	THUR. 18 SEPT. 1909	133	385	THUR. 17 SEPT. 1967	85	384	TUES. 16 SEPT. 2023
14	355	MON. 3 SEPT. 1853	71	354	TUES. 4 OCT. 1910	134	354	THUR. 5 SEPT. 1968	86	355	THUR. 3 OCT. 2024
15	355	SAT. 23 SEPT. 1854	72	355	SAT. 23 SEPT. 1911	135	355	SAT. 23 SEPT. 1969	87	354	TUES. 23 SEPT. 2025
16	383	THUR. 13 SEPT. 1855	73	385	THUR. 12 SEPT. 1912	136	383	SAT. 13 SEPT. 1970	88	385	SAT. 12 SEPT. 2026
17	354	TUES. 30 SEPT. 1856	74	354	THUR. 2 OCT. 1913	137	354	THUR. 1 OCT. 1971	89	355	SAT. 2 OCT. 2027
18	355	SAT. 19 SEPT. 1857	75	353	MON. 21 SEPT. 1914	138	355	MON. 20 SEPT. 1972	90	354	THUR. 21 SEPT. 2028
19	355	THUR. 9 SEPT. 1858	76	385	SAT. 11 SEPT. 1915	139	385	SAT. 10 SEPT. 1973	91	384	THUR. 10 SEPT. 2029
20	354	THUR. 30 SEPT. 1859	77	354	THUR. 23 SEPT. 1916	140	354	THUR. 27 SEPT. 1974	92	355	SAT. 28 SEPT. 2030
21	353	MON. 17 SEPT. 1860	78	385	MON. 17 SEPT. 1917	141	354	THUR. 17 SEPT. 1975	93	354	THUR. 18 SEPT. 2031
22	385	THUR. 5 SEPT. 1861	79	383	SAT. 7 SEPT. 1918	142	385	SAT. 6 SEPT. 1976	94	383	MON. 6 SEPT. 2032
23	385	THUR. 25 SEPT. 1862	80	354	SAT. 25 SEPT. 1919	143	353	SAT. 25 SEPT. 1977	95	355	SAT. 24 SEPT. 2033
24	383	MON. 14 SEPT. 1863	81	385	MON. 13 SEPT. 1920	144	384	TUES. 13 SEPT. 1978	96	385	THUR. 14 SEPT. 2034
25	355	SAT. 1 OCT. 1864	82	355	MON. 3 OCT. 1921	145	355	MON. 2 OCT. 1979	97	354	THUR. 4 OCT. 2035
26	354	THUR. 21 SEPT. 1865	83	383	SAT. 23 SEPT. 1922	146	355	SAT. 22 SEPT. 1980	98	353	THUR. 21 SEPT. 2036
27	385	MON. 10 SEPT. 1866	84	384	TUES. 11 SEPT. 1923	147	383	MON. 11 SEPT. 1981	99	385	THUR. 10 SEPT. 2037
28	355	MON. 30 SEPT. 1867	85	355	MON. 29 SEPT. 1924	148	354	TUES. 29 SEPT. 1982	100	354	THUR. 30 SEPT. 2038
29	354	THUR. 17 SEPT. 1868	86	355	SAT. 19 SEPT. 1925	149	355	SAT. 18 SEPT. 1983	101	355	MON. 19 SEPT. 2039
30	385	MON. 6 SEPT. 1869	87	383	THUR. 9 SEPT. 1926	150	385	THUR. 8 SEPT. 1984	102	383	SAT. 8 SEPT. 2040
31	355	SAT. 26 SEPT. 1870	88	354	TUES. 27 SEPT. 1927	151	354	THUR. 27 SEPT. 1985	103	354	THUR. 28 SEPT. 2041
32	355	SAT. 16 SEPT. 1871	89	385	SAT. 15 SEPT. 1928	152	385	MON. 16 SEPT. 1986	104	385	MON. 19 SEPT. 2042
33	354	THUR. 3 OCT. 1872	90	353	SAT. 4 OCT. 1929	153	354	SAT. 4 OCT. 1987	105	353	MON. 5 OCT. 2043
34	355	MON. 22 SEPT. 1873	91	354	TUES. 23 SEPT. 1930	154	354	THUR. 24 SEPT. 1988	106	355	THUR. 22 SEPT. 2044
35	383	SAT. 12 SEPT. 1874	92	385	SAT. 12 SEPT. 1931	155	383	MON. 12 SEPT. 1989	107	384	TUES. 12 SEPT. 2045
36	355	THUR. 30 SEPT. 1875	93	355	SAT. 1 OCT. 1932	156	355	SAT. 30 SEPT. 1990	108	355	MON. 1 OCT. 2046
37	354	TUES. 19 SEPT. 1876	94	354	THUR. 21 SEPT. 1933	157	354	THUR. 20 SEPT. 1991	109	383	SAT. 21 SEPT. 2047
38	385	SAT. 8 SEPT. 1877	95	383	MON. 10 SEPT. 1934	158	385	MON. 9 SEPT. 1992	110	385	MON. 10 SEPT. 2048
39	385	SAT. 28 SEPT. 1878	96	355	SAT. 28 SEPT. 1935	159	384	TUES. 27 SEPT. 1993	111	384	THUR. 27 SEPT. 2049
40	354	THUR. 18 SEPT. 1879	97	354	THUR. 17 SEPT. 1936	160	355	THUR. 16 SEPT. 1994	112	355	THUR. 17 SEPT. 2050
41	383	MON. 6 SEPT. 1880	98	385	MON. 6 SEPT. 1937	161	384	TUES. 6 SEPT. 1995	113	383	THUR. 7 SEPT. 2051
42	355	SAT. 24 SEPT. 1881	99	353	MON. 26 SEPT. 1938	162	355	MON. 25 SEPT. 1996	114	354	TUES. 24 SEPT. 2052
43	383	THUR. 14 SEPT. 1882	100	385	THUR. 14 SEPT. 1939	163	383	SAT. 14 SEPT. 1997	115	384	SAT. 13 SEPT. 2053
44	354	TUES. 2 OCT. 1883	101	354	THUR. 2 OCT. 1940	164	354	THUR. 2 OCT. 1998	116	353	SAT. 2 OCT. 2054
45	355	SAT. 21 SEPT. 1884	102	383	SAT. 22 SEPT. 1941	165	355	MON. 21 SEPT. 1999	117	354	THUR. 23 SEPT. 2055
46	385	THUR. 10 SEPT. 1885	103	385	SAT. 12 SEPT. 1942	166	385	SAT. 11 SEPT. 2000	118	383	MON. 11 SEPT. 2056
47	354	THUR. 30 SEPT. 1886	104	354	THUR. 30 SEPT. 1943	167	353	SAT. 30 SEPT. 2001	119	355	SAT. 29 SEPT. 2057
48	353	MON. 19 SEPT. 1887	105	355	MON. 18 SEPT. 1944	168	354	TUES. 18 SEPT. 2002	120	354	THUR. 8 SEPT. 2058
49	385	THUR. 6 SEPT. 1888	106	383	SAT. 8 SEPT. 1945	169	385	SAT. 7 SEPT. 2003	121	383	MON. 8 SEPT. 2059
50	354	THUR. 26 SEPT. 1889	107	385	THUR. 28 SEPT. 1946	170	384	SAT. 27 SEPT. 2004	122	385	SAT. 25 SEPT. 2060
51	385	MON. 15 SEPT. 1890	108	355	MON. 15 SEPT. 1947	171	383	THUR. 16 SEPT. 2005	123	384	THUR. 15 SEPT. 2061
52	355	SAT. 3 OCT. 1891	109	385	MON. 4 OCT. 1948	172	354	TUES. 4 OCT. 2006	124	355	THUR. 5 OCT. 2062
53	354	THUR. 22 SEPT. 1892	110	383	SAT. 24 SEPT. 1949	173	355	SAT. 23 SEPT. 2007	125	354	THUR. 24 SEPT. 2063
54	385	MON. 11 SEPT. 1893	111	384	TUES. 12 SEPT. 1950	174	383	THUR. 13 SEPT. 2008	126	385	THUR. 11 SEPT. 2064
55	353	MON. 1 OCT. 1894	112	355	MON. 1 OCT. 1951	175	354	TUES. 30 SEPT. 2009	127	354	THUR. 1 OCT. 2065
56	355	THUR. 19 SEPT. 1895	113	385	SAT. 18 SEPT. 1952	176	385	SAT. 18 SEPT. 2010	128	355	MON. 19 SEPT. 2066
57	385	TUES. 8 SEPT. 1896	114	383	THUR. 10 SEPT. 1953	177	385	THUR. 9 SEPT. 2011	129	384	THUR. 10 SEPT. 2067
58	355	SAT. 27 SEPT. 1897	115	354	TUES. 28 SEPT. 1954	178	354	THUR. 29 SEPT. 2012	130	355	THUR. 27 SEPT. 2068
59	385	SAT. 17 SEPT. 1898	116	385	SAT. 17 SEPT. 1955	179	353	THUR. 17 SEPT. 2013	131	383	MON. 16 SEPT. 2069
60	384	TUES. 5 SEPT. 1899	117	385	THUR. 6 SEPT. 1956	180	354	THUR. 5 SEPT. 2014	132	383	SAT. 6 SEPT. 2070
61	355	MON. 24 SEPT. 1900	118	354	THUR. 26 SEPT. 1957	181	354	THUR. 25 SEPT. 2015	133	355	THUR. 24 SEPT. 2071
62	383	SAT. 14 SEPT. 1901	119	383	MON. 15 SEPT. 1958	182	385	MON. 14 SEPT. 2016	134	354	TUES. 13 SEPT. 2072

PROF. EDWARD F. FISH, RECTOR, MADE BY J. A. ANTON.



# MOHAMMEDAN CALENDAR

The Mohammedan era, or era of the Hegira, is dated from the flight of Mohammed from Mecca to Medina, which was in the night of Thursday the 12th of July 622 A.D., and it commenced on the day following.

The years of the Hegira are purely lunar, and always consist of a period of twelve lunar months, commencing with the approximate new moon, without any intercalation to keep them to the same season with respect to the sun, so that they retrograde through all the seasons in about 32½ years. They are also partitioned into cycles of 30 years, 10 of which are common years of 354 days each, and the other 11 are intercalary years having an additional day appended to the last month.

The mean length of the year is 354 days, 8 hours, and 48 minutes, and that of the month is 29 days, 12 hours, and 44 minutes, which differs from the mean astronomical lunar month by only 2.8 seconds, so that the error amounts to only a day in about 2400 years.

To find if a year is intercalary or common, divide it by 30; the quotient will be the number of completed cycles, and the remainder will be the year of the current cycle; if this last be one of the numbers 2, 5, 7, 10, 13, 16, 18, 21, 24, 26, 29, the year is intercalary and consists of 355 days; if by any other number, the year is common.

The intercalary years of each cycle in the table of years is distinguished by an asterisk. The table of years given below shows the dates of the commencement of Mohammedan years from 1845 up to 2047, or from the 43rd to the 49th cycle inclusive, which form the whole of the seventh period of seven cycles. Throughout the next period of seven cycles, and all other like periods, the days of the week will occur in exactly the same order.

## PRINCIPLES OF THE MOHAMMEDAN RELIGION.

The religion founded by Mohammed, according to him, the only orthodox creed existing from the beginning of the world, and preached by all the prophets ever since Adam, it is also called Islam.

The fundamental principles of the religion are contained in the two articles of belief: There is no God but God; and Mohammed is God's

Apostle. The Mohammedan doctrine of God's being and attributes coincide with the Christian, so far as relates to him as the Creator of heaven and earth who rules and preserves all things, and who is without beginning, omnipotent, omniscient, omnipresent, and full of mercy.

## MOHAMMEDAN MONTHS.

Muharram . . . . .	30	Shaban . . . . .	29
Saphar . . . . .	29	Ramadan . . . . .	30
Rabia I. . . . .	29	Shawwal . . . . .	29
Rabia II. . . . .	29	Dulkada . . . . .	30
Jomada I. . . . .	30	Dulheggia . . . . .	29
Jomada II. . . . .	29	and intercalary years . . . . .	30
Rajab . . . . .	30		

## PRINCIPAL DAYS OF THE MOHAMMEDAN CALENDAR.

Muharram 1, New Year.	
10, Ashura.	
Rabia I. 11, Birth of Mohammed.	
Jomada I. 20, Taking of Constantinople.	
Rajab 15, Day of Victory.	
20, Exaltation of Mohammed.	
Shaban 15, Bora's Night.	
Shawwal 12, 3, Grand Bairam.	
Dulheggia 1, Kurban Bairam.	

## TABLE OF MOHAMMEDAN YEARS. (FROM WOOLHOUSE'S WEIGHTS, MEASURES, &C.)

YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).	YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).	YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).	YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).	YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).	YEAR OF HEGIRA.	COMMENCEMENT (IST OF MUHARRAM).
<b>43 CYCLE.</b>											
1261	FRID. 10 JAN. 1845	1301	FRID. 12 NOV. 1883	1344*	WED. 12 JULY 1925	1384	WED. 13 MAY 1964	1427	TUES. 31 JAN. 2006		
1262*	TUES. 30 DEC. 1845	1302	TUES. 21 OCT. 1884	1345	MON. 12 JULY 1926	1385*	SUN. 2 MAY 1965	1428*	SAT. 20 JAN. 2007		
1263	SUN. 20 DEC. 1846	1303*	SAT. 10 OCT. 1885	1346*	FRID. 10 JULY 1927	1386	FRI. 22 APRIL 1966	1429	THUR. 10 JAN. 2008		
1264	THUR. 9 DEC. 1847	1304	THUR. 30 SEPT. 1886	1347	WED. 20 JUNE 1928	1387*	TUES. 11 APRIL 1967	1430	MON. 29 DEC. 2008		
1265	MON. 27 NOV. 1848	1305	MON. 19 SEPT. 1887	1348	SUN. 9 JUNE 1929	1388	SUN. 31 MAR. 1968	1431*	FRID. 18 DEC. 2009		
1266	SAT. 17 NOV. 1849	1306*	FRI. 7 SEPT. 1888	1349*	THUR. 29 MAY 1930	1389	THUR. 20 MAR. 1969	1432	WED. 8 DEC. 2010		
1267*	WED. 6 NOV. 1850	1307	WED. 28 AUG. 1889	1350	TUES. 19 MAY 1931	1390*	MON. 19 MAR. 1970	1433	SUN. 27 NOV. 2011		
1268	MON. 27 OCT. 1851	1308*	MON. 17 AUG. 1890			1391	SAT. 27 FEB. 1971	1434	THUR. 15 NOV. 2012		
1269	FRI. 15 OCT. 1852	1309	FRI. 26 JULY 1891			1392	WED. 16 FEB. 1972	1435	SUN. 5 NOV. 2013		
1270*	TUES. 4 OCT. 1853	1310*	TUES. 15 JULY 1892			1393*	SAT. 4 FEB. 1973	1436*	SAT. 25 OCT. 2014		
1271	SUN. 24 SEPT. 1854	1311	SAT. 5 JULY 1893	1351	SAT. 17 MAY 1932	1394	FRI. 25 JAN. 1974	1437	THUR. 15 OCT. 2015		
1272	THUR. 13 SEPT. 1855	1312	THUR. 5 JULY 1894	1352*	WED. 26 APRIL 1933	1395	TUES. 14 JAN. 1975	1438	MON. 3 OCT. 2016		
1273*	MON. 1 SEPT. 1856	1313	MON. 24 JUNE 1895	1353	MON. 16 APRIL 1934	1396*	SAT. 3 JAN. 1976	1439*	FRI. 22 SEPT. 2017		
1274	SAT. 22 AUG. 1857	1314*	FRI. 12 JUNE 1896	1354	FRI. 5 APRIL 1935	1397	THUR. 23 DEC. 1976	1440	WED. 12 SEPT. 2018		
1275	WED. 11 AUG. 1858	1315	WED. 2 JUNE 1897	1355*	THUR. 4 MAR. 1936	1398*	MON. 12 DEC. 1977				
1276*	SUN. 31 JULY 1859	1316	SUN. 22 MAY 1898			1399	SAT. 2 DEC. 1978				
1277	FRID. 20 JULY 1860	1317	THUR. 12 MAY 1899	1357*	THUR. 3 MAR. 1939	1400	WED. 21 NOV. 1979	1441	SUN. 1 SEPT. 2019		
1278*	TUES. 9 JULY 1861			1358	TUES. 21 FEB. 1939	1401*	SUN. 9 NOV. 1980	1442	THUR. 20 AUG. 2020		
1279	SUN. 29 JUNE 1862			1359	MON. 16 APRIL 1940	1402	FRI. 30 OCT. 1981	1443	TUES. 10 AUG. 2021		
1280	THUR. 18 JUNE 1863			1360*	WED. 29 JAN. 1941	1403	TUES. 19 OCT. 1982	1444	SAT. 30 JULY 2022		
1281*	MON. 6 JUNE 1864	1321	MON. 30 MARCH 1903	1364	SUN. 19 JAN. 1942	1404*	SAT. 8 OCT. 1983	1445*	WED. 19 JULY 2023		
1282	SAT. 27 MAY 1865	1322*	FRI. 30 MARCH 1904	1365	THUR. 6 DEC. 1943	1405	THUR. 27 SEPT. 1984	1446	MON. 9 JULY 2024		
1283	WED. 16 MAY 1866	1323	WED. 8 MARCH 1905	1366*	MON. 25 NOV. 1944	1406*	MON. 16 SEPT. 1985	1447	FRI. 27 JUNE 2025		
1284*	SUN. 5 MAY 1867	1324	SUN. 25 FEB. 1906	1367	SAT. 15 NOV. 1947	1407	SUN. 14 AUG. 1986	1448	WED. 17 JUNE 2026		
1285	FRI. 24 APRIL 1868	1325*	THUR. 14 FEB. 1907	1368*	THUR. 3 NOV. 1948						
1286*	TUES. 13 APRIL 1869	1326	TUES. 4 FEB. 1908	1369	MON. 24 OCT. 1949						
1287	SUN. 3 APRIL 1870	1327*	SAT. 23 JAN. 1909	1370	FRID. 13 OCT. 1950						
1288	THUR. 23 MARCH 1871	1328	THUR. 12 JAN. 1910	1371*	TUES. 2 OCT. 1951						
1289*	MON. 11 MARCH 1872	1329	MON. 2 JAN. 1911	1372	SUN. 21 SEPT. 1952	1412*	TUES. 12 JULY 1990	1455	FRI. 2 APRIL 2033		
1290	SAT. 1 MARCH 1873	1330*	SAT. 22 DEC. 1911	1373	THUR. 10 SEPT. 1953	1413	THUR. 2 JULY 1991	1456*	SUN. 11 MAR. 2035		
<b>44 CYCLE.</b>											
1291	WED. 18 FEB. 1874	1331	WED. 11 DEC. 1912	1374*	MON. 30 AUG. 1954	1414	MON. 21 JUNE 1992	1457	SUN. 28 FEB. 2036		
1292*	SUN. 7 FEB. 1875	1332	SUN. 30 NOV. 1913	1375	SAT. 20 AUG. 1955	1415*	FRI. 10 JUNE 1993	1458	TUES. 17 FEB. 2037		
1293	FRI. 28 JAN. 1876	1333*	THUR. 19 NOV. 1914	1376*	WED. 8 AUG. 1956	1416	SUN. 31 MAY 1994	1459	SAT. 6 FEB. 2038		
1294	THUR. 16 JAN. 1877	1334	THUR. 9 NOV. 1915	1377	MON. 23 JULY 1957	1417*	SUN. 19 MAY 1995	1461	WED. 26 JAN. 2039		
1295*	SAT. 5 JAN. 1878	1335	SAT. 28 OCT. 1916	1378	FRID. 18 JULY 1958	1418	FRI. 8 MAY 1996	1462	MON. 16 JAN. 2040		
1296	THUR. 26 DEC. 1879	1336	THUR. 7 OCT. 1917	1380	SUN. 26 JUNE 1960	1420*	SAT. 17 APRIL 1997	1464	TUES. 24 DEC. 2041		
1297*	MON. 15 DEC. 1879	1337	MON. 26 SEPT. 1918			1421	THUR. 6 APRIL 2000	1465	SUN. 14 DEC. 2042		
1298	SAT. 4 DEC. 1880	1341*	THUR. 24 AUG. 1922	1381	THUR. 15 JUNE 1961	1422	MON. 26 MAR. 2001	1466*	THUR. 3 DEC. 2043		
1299	WED. 23 NOV. 1881	1342	TUES. 14 AUG. 1923	1382*	MON. 4 JUNE 1962	1423	SUN. 22 FEB. 2004	1469	WED. 31 OCT. 2046		
1300	SUN. 12 NOV. 1882	1343	SAT. 4 AUG. 1924	1383	SAT. 25 MAY 1963	1426*	THUR. 10 FEB. 2005	1470	MON. 21 OCT. 2047		





## 2-TIME TABLE NUMBER-2.

Showing the Number of Days from any Day of any one Month to the same Day of any other Month.

FOR COMMON YEARS.

FOR LEAP YEARS.

FROM	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TO
JAN.	1	31	59	89	119	148	177	206	235	264	293	31	
FEB.	31	1	30	60	90	119	148	177	206	235	264	31	
MAR.	59	30	1	31	61	91	120	149	178	207	236	32	
APR.	89	60	31	1	32	62	92	121	150	179	208	33	
MAY	119	90	61	32	1	33	63	93	122	151	180	34	
JUNE	148	119	91	62	33	1	34	64	94	123	152	35	
JULY	177	148	120	92	63	34	1	35	95	124	153	36	
AUG.	206	177	149	121	93	64	35	1	96	125	154	37	
SEPT.	235	206	178	150	94	65	36	96	1	97	126	38	
OCT.	264	235	207	179	95	66	37	97	98	1	99	39	
NOV.	293	264	236	208	96	67	38	99	99	100	1	40	
DEC.	31	32	33	34	35	36	37	38	39	40	41	42	

FROM	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TO
JAN.	1	31	60	90	120	150	180	210	240	270	300	31	
FEB.	31	1	31	61	91	121	151	181	211	241	271	32	
MAR.	60	31	1	32	62	92	122	152	182	212	272	33	
APR.	90	61	32	1	33	63	93	123	153	183	273	34	
MAY	120	91	62	33	1	34	64	94	124	154	274	35	
JUNE	150	121	92	63	34	1	35	95	125	155	275	36	
JULY	180	151	122	93	64	35	1	96	126	156	276	37	
AUG.	210	181	152	123	94	65	36	1	97	127	277	38	
SEPT.	240	211	183	154	124	95	66	97	1	98	278	39	
OCT.	270	241	212	184	155	125	96	98	99	1	279	40	
NOV.	300	271	242	213	185	156	126	99	100	101	1	41	
DEC.	31	32	33	34	35	36	37	38	39	40	41	42	

## 3-TIME TABLE NUMBER-3.

Showing the Number of Days between any two Days within three Years.

DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	1	31	59	89	119	148	177	206	235	264	293	31
2	2	32	60	90	120	150	180	210	240	270	300	32
3	3	33	61	91	121	151	181	211	241	271	301	33
4	4	34	62	92	122	152	182	212	242	272	302	34
5	5	35	63	93	123	153	183	213	243	273	303	35
6	6	36	64	94	124	154	184	214	244	274	304	36
7	7	37	65	95	125	155	185	215	245	275	305	37
8	8	38	66	96	126	156	186	216	246	276	306	38
9	9	39	67	97	127	157	187	217	247	277	307	39
10	10	40	68	98	128	158	188	218	248	278	308	40
11	11	41	69	99	129	159	189	219	249	279	309	41
12	12	42	70	100	130	160	190	220	250	280	310	42
13	13	43	71	101	131	161	191	221	251	281	311	43
14	14	44	72	102	132	162	192	222	252	282	312	44
15	15	45	73	103	133	163	193	223	253	283	313	45
16	16	46	74	104	134	164	194	224	254	284	314	46
17	17	47	75	105	135	165	195	225	255	285	315	47
18	18	48	76	106	136	166	196	226	256	286	316	48
19	19	49	77	107	137	167	197	227	257	287	317	49
20	20	50	78	108	138	168	198	228	258	288	318	50
21	21	51	79	109	139	169	199	229	259	289	319	51
22	22	52	80	110	140	170	200	230	260	290	320	52
23	23	53	81	111	141	171	201	231	261	291	321	53
24	24	54	82	112	142	172	202	232	262	292	322	54
25	25	55	83	113	143	173	203	233	263	293	323	55
26	26	56	84	114	144	174	204	234	264	294	324	56
27	27	57	85	115	145	175	205	235	265	295	325	57
28	28	58	86	116	146	176	206	236	266	296	326	58
29	29	59	87	117	147	177	207	237	267	297	327	59
30	30	60	88	118	148	178	208	238	268	298	328	60
31	31	61	89	119	149	179	209	239	269	299	329	61
32	32	62	90	120	150	180	210	240	270	300	330	62
33	33	63	91	121	151	181	211	241	271	301	331	63
34	34	64	92	122	152	182	212	242	272	302	332	64
35	35	65	93	123	153	183	213	243	273	303	333	65
36	36	66	94	124	154	184	214	244	274	304	334	66
37	37	67	95	125	155	185	215	245	275	305	335	67
38	38	68	96	126	156	186	216	246	276	306	336	68
39	39	69	97	127	157	187	217	247	277	307	337	69
40	40	70	98	128	158	188	218	248	278	308	338	70
41	41	71	99	129	159	189	219	249	279	309	339	71
42	42	72	100	130	160	190	220	250	280	310	340	72
43	43	73	101	131	161	191	221	251	281	311	341	73
44	44	74	102	132	162	192	222	252	282	312	342	74
45	45	75	103	133	163	193	223	253	283	313	343	75
46	46	76	104	134	164	194	224	254	284	314	344	76
47	47	77	105	135	165	195	225	255	285	315	345	77
48	48	78	106	136	166	196	226	256	286	316	346	78
49	49	79	107	137	167	197	227	257	287	317	347	79
50	50	80	108	138	168	198	228	258	288	318	348	80
51	51	81	109	139	169	199	229	259	289	319	349	81
52	52	82	110	140	170	200	230	260	290	320	350	82
53	53	83	111	141	171	201	231	261	291	321	351	83
54	54	84	112	142	172	202	232	262	292	322	352	84
55	55	85	113	143	173	203	233	263	293	323	353	85
56	56	86	114	144	174	204	234	264	294	324	354	86
57	57	87	115	145	175	205	235	265	295	325	355	87
58	58	88	116	146	176	206	236	266	296	326	356	88
59	59	89	117	147	177	207	237	267	297	327	357	89
60	60	90	118	148	178	208	238	268	298	328	358	90
61	61	91	119	149	179	209	239	269	299	329	359	91
62	62	92	120	150	180	210	240	270	300	330	360	92
63	63	93	121	151	181	211	241	271	301	331	361	93
64	64	94	122	152	182	212	242	272	302	332	362	94
65	65	95	123	153	183	213	243	273	303	333	363	95
66	66	96	124	154	184	214	244	274	304	334	364	96
67	67	97	125	155	185	215	245	275	305	335	365	97
68	68	98	126	156	186	216	246	276	306	336	366	98
69	69	99	127	157	187	217	247	277	307	337	367	99
70	70	100	128	158	188	218	248	278	308	338	368	100
71	71	101	129	159	189	219	249	279	309	339	369	101
72	72	102	130	160	190	220	250	280	310	340	370	102
73	73	103	131	161	191	221	251	281	311	341	371	103
74	74	104	132	162	192	222	252	282	312	342	372	104
75	75	105	133	163	193	223	253	283	313	343	373	105
76	76	106	134	164	194	224	254	284	314	344	374	106
77	77	107	135	165	195	225	255	285	315	345	375	107
78	78	108	136	166	196	226	256	286	316	346	376	108
79	79	109	137	167	197	227	257	287	317	347	377	109
80	80	110	138	168	198	228	258	288	318	348	378	110
81	81	111	139	169	199	229	259	289	319	349	379	111
82	82	112	140	170	200	230	260	290	320	350	380	112
83	83	113	141	171	201	231	261	291	321	351	381	113
84	84	114	142	172	202	232	262	292	322	352	382	114
85	85	115	143	173	203	233	263	293	323	353	383	115
86	86	116	144	174	204	234	264	294	324	354	384	116
87	87	117	145	175	205	235	265	295	325	355	385	117
88	88	118	146	176	206	236	266	296	326	356	386	118
89	89	119	147	177	207	237	267	297	327	357	387	119
90	90	120	148	178	208	238	268	298	328	358	388	120
91	91	121	149	179	209	239	269	299	329	359	389	121
92	92	122	150	180	210	240	270	300	330	360	390	122
93	93	123	151	181	211	241	271	301	331	361	391	123
94	94	124	152	182	212	242	272	302	332	362	392	124
95	95	125	153	183	213	243	273	303	333	363	393	125
96	96	126	154	184	214	244	274	304	334	364	394	126
97	97	127	155	185	215	245	275	305	335	365	395	127
98	98	128	156	186	216	246	276	306	336	366	396	128
99	99	129	157	187	217	247	277	307	337	367	397	129
100	100	130	158	188	218	248	278	308	338	368	398	130

# COMPOUND INTEREST TABLES

## I—TABLE NUMBER—1.

Showing the Accumulation of Principal and Interest on one Dollar, the Interest being compounded annually. To use Tables Nos. 1 and 2, observe at what intervals the interest is payable, also the number of such intervals, and the rate corresponding to each. Find from the tables the compound amount of \$1 for this rate and number of intervals, and multiply it by the given principal. If the number of years be greater than 30, find the product of the amounts for any two numbers of years. Thus, the amount for 47 years at 2% = 1.8113 (amt for 30 yrs) X 1.4002 (amt for 17 yrs)

Yrs.	2%	2½%	3%	3½%	4%	4½%	5%	6%	7%	8%	9%	10%
1	1.0200	1.0250	1.0300	1.0350	1.0400	1.0450	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000
2	1.0404	1.0506	1.0609	1.0712	1.0816	1.0920	1.1025	1.1238	1.1449	1.1664	1.1881	1.2100
3	1.0612	1.0769	1.0927	1.1087	1.1248	1.1411	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310
4	1.0824	1.1039	1.1255	1.1475	1.1698	1.1925	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641
5	1.1041	1.1314	1.1593	1.1877	1.2166	1.2462	1.2763	1.3382	1.4025	1.4693	1.5386	1.6105
6	1.1261	1.1597	1.1940	1.2292	1.2653	1.3022	1.3401	1.4185	1.5007	1.5868	1.6771	1.7715
7	1.1486	1.1887	1.2298	1.2723	1.3159	1.3608	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487
8	1.1716	1.2184	1.2667	1.3168	1.3685	1.4221	1.4774	1.5938	1.7182	1.8509	1.9925	2.1436
9	1.1951	1.2488	1.3047	1.3629	1.4233	1.4861	1.5513	1.6893	1.8384	1.9990	2.1719	2.3579
10	1.2190	1.2801	1.3439	1.4106	1.4802	1.5529	1.6289	1.7908	1.9671	2.1589	2.3673	2.5937
11	1.2433	1.3121	1.3842	1.4599	1.5394	1.6226	1.7103	1.8983	2.1048	2.3316	2.5804	2.8531
12	1.2682	1.3449	1.4257	1.5111	1.6012	1.6959	1.7952	2.1222	2.2532	2.5191	2.8128	3.1384
13	1.2936	1.3785	1.4685	1.5639	1.6650	1.7722	1.8856	2.1329	2.4098	2.7196	3.0658	3.4522
14	1.3194	1.4129	1.5126	1.6187	1.7317	1.8519	1.9799	2.2609	2.5785	2.9372	3.3417	3.7975
15	1.3458	1.4483	1.5579	1.6753	1.8009	1.9353	2.0789	2.3965	2.7590	3.1722	3.6425	4.1772
16	1.3728	1.4845	1.6047	1.7340	1.8730	2.0223	2.1828	2.5403	2.9521	3.4269	3.9703	4.5949
17	1.4002	1.5216	1.6528	1.7946	1.9479	2.1134	2.2920	2.6927	3.1588	3.7000	4.3278	5.0544
18	1.4282	1.5596	1.7024	1.8575	2.0258	2.2085	2.4066	2.8543	3.3799	3.9960	4.7171	5.5599
19	1.4568	1.5986	1.7535	1.9225	2.1068	2.3078	2.5269	3.0256	3.6165	4.2157	5.0416	6.1159
20	1.4859	1.6386	1.8061	1.9988	2.1911	2.4117	2.6533	3.2071	3.8697	4.6609	5.6044	6.7275
21	1.5156	1.6796	1.8603	2.0594	2.2787	2.5202	2.7859	3.3995	4.1405	5.0338	6.1088	7.4002
22	1.5459	1.7215	1.9101	2.1315	2.3699	2.6336	2.9252	3.6035	4.4304	5.4365	6.6586	8.1403
23	1.5769	1.7646	1.9736	2.2061	2.4647	2.7521	3.0715	3.8197	4.7405	5.8714	7.2578	8.9543
24	1.6084	1.8087	2.0328	2.2833	2.5633	2.8760	3.2251	4.0489	5.0723	6.3412	7.9111	9.8497
25	1.6406	1.8539	2.0937	2.3633	2.6658	3.0054	3.3863	4.2918	5.4274	6.8485	8.6321	10.8347
26	1.6734	1.9003	2.1566	2.4459	2.7724	3.1407	3.5556	4.5494	5.8073	7.3963	9.3991	11.9182
27	1.7069	1.9478	2.2213	2.5315	2.8833	3.2820	3.7334	4.8223	6.2138	7.9880	10.2451	13.1100
28	1.7410	1.9965	2.2879	2.6201	2.9987	3.4297	3.9201	5.1117	6.6488	8.6271	11.1671	14.4210
29	1.7758	2.0464	2.3565	2.7119	3.1186	3.5840	4.1161	5.4184	7.1142	9.3173	12.1722	15.8631
30	1.8113	2.0975	2.4272	2.8068	3.2454	3.7453	4.3219	5.7435	7.6122	10.0628	13.2677	17.4494

## 2—TABLE NUMBER—2.

Showing the Accumulation of Principal and Interest on one Dollar, the Interest being compounded semi-annually.

Yrs.	2%	2½%	3%	3½%	4%	4½%	5%	6%	7%	8%	9%	10%
1	1.0201	1.0251	1.0302	1.0353	1.0404	1.0455	1.0506	1.0609	1.0712	1.0816	1.0920	1.1025
2	1.0406	1.0519	1.0633	1.0748	1.0864	1.0980	1.1098	1.1235	1.1375	1.1516	1.1658	1.1801
3	1.0615	1.0783	1.0954	1.1126	1.1300	1.1475	1.1652	1.1840	1.2030	1.2222	1.2415	1.2610
4	1.0828	1.1054	1.1284	1.1518	1.1755	1.1994	1.2234	1.2486	1.2740	1.3000	1.3260	1.3522
5	1.1046	1.1322	1.1605	1.1894	1.2188	1.2487	1.2790	1.3393	1.4105	1.4794	1.5497	1.6207
6	1.1268	1.1617	1.1956	1.2324	1.2681	1.3048	1.3448	1.4257	1.5110	1.6002	1.7141	1.7957
7	1.1494	1.1909	1.2317	1.2759	1.3193	1.3643	1.4129	1.5125	1.6186	1.7307	1.8719	1.9747
8	1.1725	1.2209	1.2689	1.3210	1.3726	1.4264	1.4845	1.6047	1.7339	1.8720	2.0641	2.1827
9	1.1960	1.2516	1.3073	1.3676	1.4281	1.4913	1.5596	1.7024	1.8574	2.0247	2.2541	2.4664
10	1.2200	1.2831	1.3463	1.4154	1.4858	1.5592	1.6385	1.8061	1.9897	2.1899	2.4615	2.6520
11	1.2445	1.3154	1.3875	1.4654	1.5458	1.6301	1.7234	1.9161	2.1315	2.3687	2.6880	2.9250
12	1.2696	1.3484	1.4295	1.5171	1.6082	1.7044	1.8086	2.0326	2.2833	2.5619	2.9354	3.2248
13	1.2951	1.3824	1.4727	1.5704	1.6732	1.7820	1.9001	2.1564	2.4459	2.7710	3.2055	3.5588
14	1.3211	1.4171	1.5172	1.6259	1.7408	1.8631	1.9963	2.2878	2.6201	2.9971	3.5005	3.9198
15	1.3477	1.4527	1.5630	1.6833	1.8111	1.9479	2.0933	2.4271	2.8068	3.2417	3.8227	4.3216
16	1.3748	1.4893	1.6103	1.7428	1.8843	2.0365	2.2027	2.5749	3.0067	3.5062	4.1744	4.7645
17	1.4024	1.5268	1.6589	1.8043	1.9604	2.1272	2.3142	2.7317	3.2208	3.7923	4.5586	5.2529
18	1.4307	1.5652	1.7091	1.8680	2.0396	2.2240	2.4313	2.8981	3.4502	4.1018	4.9781	5.7883
19	1.4593	1.6045	1.7607	1.9339	2.1220	2.3252	2.5544	3.0746	3.6960	4.4365	5.4362	6.3816
20	1.4886	1.6449	1.8140	2.0022	2.2078	2.4310	2.6837	3.2618	3.9592	4.7995	5.9370	7.0362
21	1.5185	1.6863	1.8686	2.0729	2.2970	2.5415	2.8196	3.4605	4.2412	5.1900	6.4833	7.7574
22	1.5490	1.7287	1.9253	2.1451	2.3898	2.6572	2.9624	3.6712	4.5433	5.6136	7.0900	8.5575
23	1.5801	1.7722	1.9835	2.2308	2.4863	2.7781	3.1233	3.8948	4.8669	6.0116	7.7525	9.3932
24	1.6118	1.8168	2.0434	2.3292	2.5868	2.8945	3.2699	4.1326	5.2136	6.5671	8.4659	10.3935
25	1.6442	1.8625	2.1052	2.3804	2.6913	3.0367	3.4354	4.3836	5.5849	7.1030	9.2450	11.4612
26	1.6772	1.9093	2.1688	2.4645	2.8006	3.1749	3.6094	4.6506	5.9827	7.6826	10.0958	12.6359
27	1.7110	1.9577	2.2349	2.5515	2.9131	3.3183	3.7921	4.9343	6.3816	8.3084	11.0452	13.9747
28	1.7453	2.0066	2.3039	2.6416	3.0318	3.4703	3.9841	5.2343	6.8553	8.9875	12.0394	15.3591
29	1.7804	2.0571	2.3715	2.7348	3.1543	3.6282	4.1858	5.5531	7.3543	9.7208	13.1473	16.9334
30	1.8163	2.1098	2.4432	2.8314	3.2818	3.7933	4.3977	5.8913	7.8781	10.5143	14.3572	18.6691

FROM PEN COPY BY THE AUTHOR



### 3-TABLE NUMBER-3.

Giving the Present Worth or Value of \$1 Annuity per annum at Compound Interest. To use the table, multiply the annuity by the present value of \$1 annuity at the required time and rate as given in the table. **Example.**—A widow is entitled to \$120 a year, payable annually, for 25 years at 6%; what is the present value of her interest? **Solution.**—\$120 (the annuity) x \$12.7833 (the present value of \$1 annuity for 25 years, at 6%) = \$1534.00. If the annuity be payable semi-annually and semi-annual interest is to be allowed, take the present value for double the number of years, at one-half the given rate. **Thus,** an annuity of \$1 every six months, for 10 yrs. at 6% per annum for 20 yrs. at 3%.

Yrs.	2%	2½%	3%	3½%	4%	4½%	5%	6%	7%	8%	9%	10%
1	0.9804	0.9758	0.9708	0.9662	0.9615	0.9569	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091
2	1.9415	1.9275	1.9134	1.8997	1.8861	1.8726	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355
3	2.8839	2.8560	2.8286	2.8016	2.7751	2.7489	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869
4	3.8077	3.7619	3.7170	3.6731	3.6299	3.5875	3.5459	3.4651	3.3872	3.3121	3.2397	3.1699
5	4.7134	4.6458	4.5797	4.5150	4.4518	4.3899	4.3295	4.2123	4.1002	3.9927	3.8896	3.7908
6	5.6014	5.5081	5.4172	5.3285	5.2421	5.1578	5.0757	4.9173	4.7685	4.6229	4.5216	4.4253
7	6.4713	6.3494	6.2303	6.1145	6.0020	5.8926	5.7864	5.5824	5.3893	5.2064	5.0857	4.9684
8	7.3255	7.1707	7.0193	6.8739	6.7327	6.5958	6.4632	6.1907	5.9719	5.7664	5.5648	5.3669
9	8.1622	7.9708	7.7861	7.6077	7.4353	7.2687	7.1078	6.8017	6.5152	6.2469	6.0228	5.7590
10	8.9826	8.7521	8.5302	8.3166	8.1109	7.9121	7.7217	7.3601	7.0236	6.7101	6.4429	6.1446
11	9.7868	9.5142	9.2526	9.0015	8.7605	8.5288	8.3064	7.8869	7.4987	7.1390	6.8284	6.4951
12	10.5753	10.2578	9.9540	9.6633	9.3851	9.1185	8.8632	8.3838	7.9427	7.5361	7.1888	6.8137
13	11.3484	10.9831	10.6349	10.3027	9.9856	9.6828	9.3936	8.8527	8.3576	7.9038	7.5131	7.1034
14	12.1063	11.6902	11.2959	10.9205	10.5633	10.2243	9.8986	9.2850	8.7453	8.2427	7.8101	7.3609
15	12.8493	12.3814	11.9339	11.5774	11.2384	10.9164	10.6025	9.7976	9.2122	8.7099	8.2626	7.8061
16	13.5777	13.0550	12.5611	12.0941	11.6523	11.2339	10.8278	10.0599	9.4666	8.9514	8.5226	8.0737
17	14.2916	13.7122	13.2651	12.8133	12.3865	11.9827	11.5914	10.7721	9.7632	9.1216	8.5621	8.0216
18	14.9921	14.3534	13.7535	13.1897	12.6593	12.1600	11.6896	10.8276	10.0591	9.3719	8.7725	8.2014
19	15.6784	14.9163	14.3238	13.7098	13.1339	12.5932	12.0853	11.1581	10.3356	9.6036	8.9656	8.3649
20	16.3514	15.5891	14.8774	14.2124	13.5903	13.0079	12.4622	11.4694	10.5940	9.8181	9.1428	8.5136
21	17.0112	16.1606	15.4150	14.6979	14.0291	13.4047	12.8211	11.7641	10.8355	10.0168	9.3053	8.6487
22	17.6581	16.7421	15.9369	15.1671	14.4511	13.7844	13.1630	12.0416	11.0612	10.2007	9.4543	8.7715
23	18.2922	17.3094	16.4436	15.6104	14.8368	14.1478	13.4983	12.2034	11.2712	10.3711	9.5912	8.8892
24	18.9138	17.8628	16.9355	16.0593	15.2669	14.5650	13.7986	12.4503	11.4693	10.5288	9.7167	8.9847
25	19.5235	18.4028	17.4131	16.4815	15.6221	14.8282	14.0939	12.7833	11.6536	10.6748	9.8330	9.0770
26	20.1150	18.9296	17.8768	16.8992	15.9827	15.1466	14.2752	13.0032	11.8258	10.8100	9.9375	9.1609
27	20.7069	19.4435	18.3270	17.2853	16.3296	15.4513	14.5430	13.2105	11.9887	10.9352	10.0344	9.2372
28	21.2813	19.9448	18.7641	17.6670	16.6630	15.7429	14.8981	13.4062	12.1371	11.0511	10.1233	9.3066
29	21.8444	20.4339	19.1884	18.0357	16.9837	16.0219	15.1411	13.5907	12.2777	11.1584	10.2048	9.3898
30	22.3964	20.9113	19.6004	18.3920	17.2920	16.2869	15.3724	13.7648	12.4090	11.2578	10.2874	9.4269

### 4-TABLE NUMBER-4.

Giving the Amount of \$1 Annuity per annum at Compound Interest. To use the table, multiply the annuity by the amount of \$1 for the required time at the required rate and intervals as given in the table. **Example.**—At the birth of a son a father invests for him \$100 at 5%, interest computed annually, and the same amount with accrued interest on each birthday thereafter till the son is 21 years old; what sum will the son have when he comes of age? **Solution.**—\$100 (the annuity) x \$57.1193 (the amount of \$1 annuity for 21 yrs. at 5%) = \$5711.93.

Yrs.	2%	2½%	3%	3½%	4%	4½%	5%	6%	7%	8%	9%	10%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0200	2.0250	2.0300	2.0350	2.0400	2.0450	2.0500	2.0600	2.0700	2.0800	2.0900	2.1000
3	3.0604	3.0756	3.0907	3.1057	3.1206	3.1354	3.1501	3.1749	3.2000	3.2250	3.2500	3.2750
4	4.1216	4.1525	4.1836	4.2145	4.2455	4.2762	4.3101	4.3748	4.4399	4.5051	4.5701	4.6401
5	5.2040	5.2563	5.3091	5.3623	5.4159	5.4707	5.5256	5.6371	5.7507	5.8666	5.9847	6.1051
6	6.3081	6.3877	6.4684	6.5502	6.6330	6.7169	6.8019	6.9753	7.1533	7.3359	7.5233	7.7156
7	7.4342	7.5474	7.6625	7.7794	7.8983	8.0191	8.1420	8.3938	8.6540	8.9228	9.2004	9.4872
8	8.5829	8.7361	8.8923	9.0517	9.2142	9.3800	9.5491	9.9759	10.2598	10.6366	11.0284	11.4359
9	9.7546	9.9545	10.1591	10.3685	10.5828	10.8021	11.0265	11.4913	11.9780	12.4876	13.0101	13.5395
10	10.9437	11.2034	11.4639	11.7314	12.0061	12.2882	12.5779	13.1008	13.6164	14.1666	14.7529	15.3374
11	12.1687	12.4834	12.8078	13.1420	13.4864	13.8411	14.2068	14.7176	15.2836	15.8655	16.4203	16.9812
12	13.4211	13.7955	14.1720	14.5520	14.9358	15.3234	15.7149	16.8699	17.8885	18.9771	20.2207	21.5845
13	14.6903	15.1046	15.5178	15.9300	16.3422	16.7544	17.1666	18.8221	20.1406	21.4953	23.0334	24.5227
14	15.9739	16.5189	17.0663	17.6170	18.1719	18.7311	19.2946	21.0151	22.5505	24.1741	26.0992	27.8750
15	17.2934	17.9319	18.5899	19.2597	19.9326	20.7840	21.5786	23.7760	25.1290	27.1521	29.4409	31.7725
16	18.6392	19.3902	20.1569	20.9178	21.8245	22.7193	23.6575	25.6725	27.8881	30.3243	33.0834	35.9487
17	20.0120	20.8047	21.7616	22.7050	23.6975	24.7417	25.8404	28.2129	30.8402	33.7502	37.0537	40.5447
18	21.4123	22.3863	23.4144	24.4997	25.6454	26.8550	28.1324	30.9057	33.9990	37.4502	41.3812	45.5992
19	22.8405	23.9460	25.1699	26.3572	27.6171	28.9633	30.3930	33.7650	37.3790	41.4463	45.0984	51.1591
20	24.3973	25.6442	26.9704	28.3797	29.8181	31.3714	32.9680	36.7805	40.9955	45.7626	51.2401	57.2500
21	25.9731	27.3437	28.7655	30.2688	31.7692	33.3831	35.7193	39.9927	44.8652	50.4229	56.8445	64.0025
22	27.5893	28.9226	30.5168	32.3280	34.2480	36.3033	38.5952	43.3922	49.0057	55.8568	62.9533	71.4027
23	28.9444	30.5444	32.4529	34.6665	36.6179	38.9370	41.4205	46.9958	53.6181	60.8938	69.6119	79.5450
24	30.4218	32.3090	34.4265	36.6666	39.0826	41.6892	44.5020	50.8156	58.1767	66.7648	76.6898	88.4793
25	32.0303	34.1177	36.4253	38.9498	41.6459	44.5652	47.7221	54.8643	63.2490	73.1059	84.7893	98.3470
26	33.6709	35.7171	38.5530	41.2139	44.3117	47.5706	51.1135	59.1564	68.6765	79.9544	93.4040	108.1817
27	35.3443	37.3720	40.7696	43.7598	47.0842	50.7113	54.6691	63.7057	74.4838	87.3508	102.8031	120.0299
28	37.0512	39.1898	42.9309	46.2914	49.7676	53.9933	58.4026	68.5287	80.6977	95.2394	112.4482	132.2099
29	38.7922	41.0163	45.1888	48.8116	52.3668	57.4240	62.3717	73.6665	87.3465	103.9959	124.2152	143.9001
30	40.5680	42.8627	47.5754	51.6235	55.0849	60.0973	65.3832	79.0588	94.4608	112.2802	136.3875	164.9440



**AT FOUR PER CENT**

[illegible]

**AT FIVE PER CENT**

[illegible]

MONTHS												YEARS							
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WATER	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
INTEREST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1				

To find the interest at 2%, find it at 4% by the table, and take half the amount; for 3%, take half the amount for 6%; for 2½%, take half of 5%; for 3½%, take half of 7%; for 8%, take twice 4%; for 10%, take twice 5%; for 12%, take twice 6%. The table is so constructed as to be the most possible convenient for computing interest with rapidity, the amount and the interest being given together in the same rectangular space, so that when the time is known, simply descend the column to the required amount (the back-hand number) where will be found the interest just beneath it. The interest at any per cent. not given in the table or mentioned above, may be found readily by proportion.

## AT SIX PER CENT

	DAYS																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100								

	MONTHS											YEARS							
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

## AT SEVEN PER CENT

		DAYS																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	10			

	MONTHS											YEARS							
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMOUNT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
INTEREST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



# FRACTIONAL MULTIPLICATION TABLE.

THE Table is especially valuable to engravers, electrotypers, and all others having frequent occasion to find the products of numbers, both integral and fractional, not exceeding 20. To use the table, select either dimension at the top margin, then descend the column to the other (shown by the small number above the large), where is given the integral product, to which must be added the fractional units. **Example:**—What is the product of  $17\frac{5}{8}$  multiplied by  $19\frac{7}{8}$ ? **Solution.**—From 17 at the top descend the column to 19, where is found 323, the integral product; then there are 19 times  $\frac{5}{8}$  (shown by 19 above the 323), which =  $\frac{95}{8}$ ; (use the table in multiplying 5 by 19); also 17 times  $\frac{7}{8}$  (shown by 17 at the left of the 323), which =  $\frac{119}{8}$ ; adding  $\frac{95}{8}$  and  $\frac{119}{8}$ , the sum is  $\frac{214}{8} = 26\frac{3}{4}$ ;  $323 + 26\frac{3}{4} = 349\frac{3}{4}$ . The small corner  $\frac{5}{8}$  by  $\frac{7}{8}$ , may be added if desired.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
11	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220
12	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
13	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260
14	14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280
15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300
16	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320
17	17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340
18	18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360
19	19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380
20	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400



# TWILIGHT TABLE.



Showing the beginning and end of twilight for the first, eleventh, and twenty-first days of every month, as seen on the parallels of 27°, 30°, 33°, 36°, 39°, 42°, 45°, and 48° north latitude, and by estimation, will serve equally well for adjacent points.

Months.	L A T I T U D E.															
	27°		30°		33°		36°		39°		42°		45°		48°	
	Begin.	Ends	Begin.	Ends	Begin.	Ends	Begin.	Ends	Begin.	Ends	Begin.	Ends	Begin.	Ends	Begin.	Ends
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
JAN.	h 11	m 28	h 11	m 45	h 11	m 33	h 11	m 38	h 11	m 40	h 11	m 24	h 11	m 53	h 11	m 58
" 11	5 28	6 45	5 30	6 45	5 36	6 40	5 39	6 34	5 42	6 32	5 45	6 30	5 50	6 18	5 52	6 12
" 21	5 27	6 50	5 30	6 45	5 36	6 40	5 39	6 34	5 42	6 32	5 45	6 30	5 50	6 18	5 52	6 12
FEB.	h 11	m 24	h 11	m 54	h 11	m 28	h 11	m 51	h 11	m 25	h 11	m 37	h 11	m 50	h 11	m 47
" 11	5 22	7 0	5 26	6 59	5 30	6 57	5 32	6 54	5 35	6 52	5 37	6 50	5 39	6 39	5 42	6 36
" 21	5 20	7 8	5 22	7 8	5 25	6 54	5 25	6 54	5 28	7 0	5 30	6 50	5 35	6 45	5 36	6 48
MAR.	h 11	m 16	h 11	m 14	h 11	m 15	h 11	m 15	h 11	m 15	h 11	m 17	h 11	m 15	h 11	m 15
" 11	5 16	7 14	5 16	7 13	5 15	7 13	5 15	7 12	5 15	7 12	5 17	7 9	5 17	7 6	5 15	7 0
" 21	5 8	7 18	5 7	7 18	5 6	7 19	5 5	7 20	5 4	7 21	5 2	7 23	5 4	7 25	5 4	7 27
APR.	h 11	m 5	h 11	m 22	h 11	m 4	h 11	m 27	h 11	m 4	h 11	m 46	h 11	m 7	h 11	m 35
" 11	5 0	7 22	4 57	7 24	4 53	7 27	4 51	7 29	4 48	7 31	4 46	7 35	4 43	7 37	4 42	7 39
" 21	4 50	7 27	4 46	7 31	4 41	7 35	4 38	7 38	4 34	7 42	4 33	7 47	4 31	7 50	4 28	7 54
MAY.	h 11	m 4	h 11	m 37	h 11	m 24	h 11	m 43	h 11	m 19	h 11	m 54	h 11	m 8	h 11	m 45
" 11	4 37	7 32	4 29	7 37	4 19	7 52	4 19	7 48	4 14	7 54	4 6	8 2	3 52	8 8	3 45	8 12
" 21	4 25	7 40	4 18	7 46	4 10	7 55	4 3	7 59	3 56	8 20	3 25	8 32	3 13	8 47	3 56	8 40
JUN.	h 11	m 4	h 11	m 0	h 11	m 31	h 11	m 42	h 11	m 31	h 11	m 33	h 11	m 3	h 11	m 25
" 11	4 0	8 0	3 51	8 8	3 42	8 12	3 31	8 22	3 21	8 33	3 5	8 45	2 47	9 6	2 6	9 27
" 21	3 45	8 11	3 37	8 17	3 30	8 22	3 17	8 33	3 5	8 45	2 47	9 6	2 29	9 31	2 6	9 54
JULY.	h 11	m 3	h 11	m 26	h 11	m 28	h 11	m 35	h 11	m 27	h 11	m 31	h 11	m 23	h 11	m 34
" 11	3 30	8 21	3 26	8 28	3 21	8 35	3 7	8 44	2 52	8 57	2 31	9 23	2 8	9 52	1 34	10 26
" 21	3 18	8 41	3 13	8 45	3 10	8 51	2 50	9 11	2 36	9 21	2 13	9 51	1 39	10 30	12	11 36
AUG.	h 11	m 3	h 11	m 44	h 11	m 8	h 11	m 54	h 11	m 25	h 11	m 55	h 11	m 34	h 11	m 50
" 11	3 15	8 44	3 11	8 49	3 8	8 54	2 45	9 22	2 38	9 28	2 8	9 55	1 39	10 30	12	11 50
" 21	3 21	8 42	3 13	8 47	3 13	8 51	2 57	9 5	2 40	9 25	2 14	9 50	1 39	10 37	12	11 27
SEP.	h 11	m 3	h 11	m 37	h 11	m 19	h 11	m 48	h 11	m 7	h 11	m 49	h 11	m 16	h 11	m 10
" 11	3 20	8 37	3 19	8 44	3 20	8 48	3 7	9 0	2 50	9 19	2 9	9 42	1 49	10 16	10	11 43
" 21	3 22	8 27	3 33	8 38	3 29	8 41	3 15	8 52	3 0	9 9	2 39	9 29	2 2	9 58	1	10 21
OCT.	h 11	m 3	h 11	m 48	h 11	m 30	h 11	m 40	h 11	m 30	h 11	m 57	h 11	m 18	h 11	m 10
" 11	3 55	8 14	3 47	8 10	3 40	8 31	3 27	8 43	3 15	8 57	2 57	9 16	2 18	9 42	1	10 50
" 21	4 10	8 0	3 0	8 10	3 50	8 19	3 40	8 15	3 28	8 41	3 18	8 29	2 36	9 22	12	10 30
NOV.	h 11	m 20	h 11	m 14	h 11	m 7	h 11	m 51	h 11	m 8	h 11	m 22	h 11	m 5	h 11	m 20
" 11	4 20	7 31	4 14	7 31	4 9	7 51	4 2	8 58	3 55	8 4	3 45	8 14	3 24	8 35	5	8 11
" 21	4 25	7 22	4 20	7 30	4 15	7 36	4 1	7 40	4 7	7 46	3 59	7 54	3 50	8 10	3	8 25
DEC.	h 11	m 4	h 11	m 26	h 11	m 14	h 11	m 29	h 11	m 7	h 11	m 28	h 11	m 7	h 11	m 8
" 11	4 36	7 8	4 33	7 9	4 31	7 10	4 29	7 11	4 27	7 12	4 24	7 15	4 20	7 30	4	7 46
" 21	4 40	7 0	4 39	6 57	4 39	6 54	4 38	6 55	4 37	6 56	4 36	6 58	4 30	7 19	4	7 34
JAN.	h 11	m 4	h 11	m 46	h 11	m 46	h 11	m 43	h 11	m 45	h 11	m 46	h 11	m 41	h 11	m 48
" 11	4 52	6 37	4 53	6 35	4 54	6 33	4 55	6 31	4 57	6 35	4 58	6 39	5 0	6 49	5	7 22
" 21	5 0	6 30	5 1	6 28	5 2	6 26	5 5	6 23	5 7	6 21	5 9	6 19	5 13	6 39	5	7 16
FEB.	h 11	m 5	h 11	m 28	h 11	m 10	h 11	m 25	h 11	m 13	h 11	m 16	h 11	m 12	h 11	m 32
" 11	5 10	6 26	5 13	6 23	5 17	6 21	5 21	6 17	5 25	6 14	5 29	6 11	5 37	6 25	5	7 48
" 21	5 15	6 24	5 20	6 22	5 25	6 20	5 29	6 15	5 33	6 12	5 38	6 10	5 44	6 20	5	7 37
MAR.	h 11	m 5	h 11	m 23	h 11	m 6	h 11	m 19	h 11	m 5	h 11	m 10	h 11	m 5	h 11	m 33



## WEATHER WISDOM.



**Weather** is the condition of the atmosphere at any time and place with respect chiefly to its temperature, humidity, clearness or cloudiness, rain, fog, or snow, and wind.

**Barometer.**—In prognosticating the weather by the barometer, notice whether it be greatly above or below the mean height, and the rapidity of its rise or fall. Higher and steady, foretells continued fair weather. Lower and falling, rain or damp cloudy weather. Rapid rise or fall, continued unsettled weather and much wind.

**Clouds.**—Clouds are distinguished by their textures, motions, and outlines. The **cirrus**, or "mare's tails," appear at a greater elevation than other forms, and are marked by their light texture, fibrous and sundered, or interlacing as in the far-spreading white cloud which produces the halo. **Small**, regularly

formed groups of these clouds are frequently seen in fair and settled weather. The **cirri** are also the clouds on the fore-part of the storm, where they are usually more abundant, very ragged, and generally blend into a white, far-reaching cloud-bank. The **cumulus**, "cotton der-heads," or "cotton bales," are of a hemispherical form, with horizontal base. When they appear in the heat of the day and pass away in the evening, they foretell continued fair weather. If they increase rapidly, sink into the lower atmosphere, and remain as evening approaches, rain is at hand. Loose patches on their surfaces predict showers. The **stratus** appear as a continuous layer of widely extended sheet of cloud, at a lower level than the cumulus, and often touching the earth.

**Corona.**—Circles around the moon or sun. Growing smaller they indicate rain; growing larger, fair weather.

**Fogs.**—Fogs indicate settled weather. Morning fogs seldom last till noon.

**Frost.**—First and last frosts are usually preceded by a temperature much above mean.

**Halo** (sun-dogs).—Large circles, or parts of circles, about the sun or moon. A halo after fine weather indicates a storm.

**Rainbows.**—A morning rainbow indicates rain; an evening one, fair weather.

**Sky Color.**—A deep-blue sky, even if seen through clouds, indicates fair weather; a growing whiteness, a storm.

**Sunset Colors.**—A gray, lowering sunset, or one where the sky is green or yellowish green, indicates rain. A red sunset foretells fine weather.

**Sunrise Colors.**—A red sunrise, with lowering clouds later in the morning, indicate rain; a gray sunrise, dry weather.

**Visibility.**—Unusual clearness of the atmosphere, unusual brightness or twinkling of the stars, indicate rain.



# Table of Distances. Mean Annual Temperature and Average Annual Rainfall.

and the Air-Line Distances between the Leading Cities of the United States; also, the Mean Annual Temperature, and Average Annual Rainfall.

Copyright, 1894, by J. S. G. Co.

## FROM NEW YORK

ENGLISH MILES	METRIC MILES	FROM NEW YORK
10	16.09	ALBANY, N.Y.
20	32.18	ALBANY, N.Y.
30	48.27	ALBANY, N.Y.
40	64.36	ALBANY, N.Y.
50	80.45	ALBANY, N.Y.
60	96.54	ALBANY, N.Y.
70	112.63	ALBANY, N.Y.
80	128.72	ALBANY, N.Y.
90	144.81	ALBANY, N.Y.
100	160.90	ALBANY, N.Y.
110	176.99	ALBANY, N.Y.
120	193.08	ALBANY, N.Y.
130	209.17	ALBANY, N.Y.
140	225.26	ALBANY, N.Y.
150	241.35	ALBANY, N.Y.
160	257.44	ALBANY, N.Y.
170	273.53	ALBANY, N.Y.
180	289.62	ALBANY, N.Y.
190	305.71	ALBANY, N.Y.
200	321.80	ALBANY, N.Y.
210	337.89	ALBANY, N.Y.
220	353.98	ALBANY, N.Y.
230	370.07	ALBANY, N.Y.
240	386.16	ALBANY, N.Y.
250	402.25	ALBANY, N.Y.
260	418.34	ALBANY, N.Y.
270	434.43	ALBANY, N.Y.
280	450.52	ALBANY, N.Y.
290	466.61	ALBANY, N.Y.
300	482.70	ALBANY, N.Y.
310	498.79	ALBANY, N.Y.
320	514.88	ALBANY, N.Y.
330	530.97	ALBANY, N.Y.
340	547.06	ALBANY, N.Y.
350	563.15	ALBANY, N.Y.
360	579.24	ALBANY, N.Y.
370	595.33	ALBANY, N.Y.
380	611.42	ALBANY, N.Y.
390	627.51	ALBANY, N.Y.
400	643.60	ALBANY, N.Y.
410	659.69	ALBANY, N.Y.
420	675.78	ALBANY, N.Y.
430	691.87	ALBANY, N.Y.
440	707.96	ALBANY, N.Y.
450	724.05	ALBANY, N.Y.
460	740.14	ALBANY, N.Y.
470	756.23	ALBANY, N.Y.
480	772.32	ALBANY, N.Y.
490	788.41	ALBANY, N.Y.
500	804.50	ALBANY, N.Y.
510	820.59	ALBANY, N.Y.
520	836.68	ALBANY, N.Y.
530	852.77	ALBANY, N.Y.
540	868.86	ALBANY, N.Y.
550	884.95	ALBANY, N.Y.
560	901.04	ALBANY, N.Y.
570	917.13	ALBANY, N.Y.
580	933.22	ALBANY, N.Y.
590	949.31	ALBANY, N.Y.
600	965.40	ALBANY, N.Y.
610	981.49	ALBANY, N.Y.
620	997.58	ALBANY, N.Y.
630	1013.67	ALBANY, N.Y.
640	1029.76	ALBANY, N.Y.
650	1045.85	ALBANY, N.Y.
660	1061.94	ALBANY, N.Y.
670	1078.03	ALBANY, N.Y.
680	1094.12	ALBANY, N.Y.
690	1110.21	ALBANY, N.Y.
700	1126.30	ALBANY, N.Y.
710	1142.39	ALBANY, N.Y.
720	1158.48	ALBANY, N.Y.
730	1174.57	ALBANY, N.Y.
740	1190.66	ALBANY, N.Y.
750	1206.75	ALBANY, N.Y.
760	1222.84	ALBANY, N.Y.
770	1238.93	ALBANY, N.Y.
780	1255.02	ALBANY, N.Y.
790	1271.11	ALBANY, N.Y.
800	1287.20	ALBANY, N.Y.
810	1303.29	ALBANY, N.Y.
820	1319.38	ALBANY, N.Y.
830	1335.47	ALBANY, N.Y.
840	1351.56	ALBANY, N.Y.
850	1367.65	ALBANY, N.Y.
860	1383.74	ALBANY, N.Y.
870	1399.83	ALBANY, N.Y.
880	1415.92	ALBANY, N.Y.
890	1432.01	ALBANY, N.Y.
900	1448.10	ALBANY, N.Y.
910	1464.19	ALBANY, N.Y.
920	1480.28	ALBANY, N.Y.
930	1496.37	ALBANY, N.Y.
940	1512.46	ALBANY, N.Y.
950	1528.55	ALBANY, N.Y.
960	1544.64	ALBANY, N.Y.
970	1560.73	ALBANY, N.Y.
980	1576.82	ALBANY, N.Y.
990	1592.91	ALBANY, N.Y.
1000	1609.00	ALBANY, N.Y.

## FROM NEW YORK

ENGLISH MILES	METRIC MILES	FROM NEW YORK
10	16.09	ALBANY, N.Y.
20	32.18	ALBANY, N.Y.
30	48.27	ALBANY, N.Y.
40	64.36	ALBANY, N.Y.
50	80.45	ALBANY, N.Y.
60	96.54	ALBANY, N.Y.
70	112.63	ALBANY, N.Y.
80	128.72	ALBANY, N.Y.
90	144.81	ALBANY, N.Y.
100	160.90	ALBANY, N.Y.
110	176.99	ALBANY, N.Y.
120	193.08	ALBANY, N.Y.
130	209.17	ALBANY, N.Y.
140	225.26	ALBANY, N.Y.
150	241.35	ALBANY, N.Y.
160	257.44	ALBANY, N.Y.
170	273.53	ALBANY, N.Y.
180	289.62	ALBANY, N.Y.
190	305.71	ALBANY, N.Y.
200	321.80	ALBANY, N.Y.
210	337.89	ALBANY, N.Y.
220	353.98	ALBANY, N.Y.
230	370.07	ALBANY, N.Y.
240	386.16	ALBANY, N.Y.
250	402.25	ALBANY, N.Y.
260	418.34	ALBANY, N.Y.
270	434.43	ALBANY, N.Y.
280	450.52	ALBANY, N.Y.
290	466.61	ALBANY, N.Y.
300	482.70	ALBANY, N.Y.
310	498.79	ALBANY, N.Y.
320	514.88	ALBANY, N.Y.
330	530.97	ALBANY, N.Y.
340	547.06	ALBANY, N.Y.
350	563.15	ALBANY, N.Y.
360	579.24	ALBANY, N.Y.
370	595.33	ALBANY, N.Y.
380	611.42	ALBANY, N.Y.
390	627.51	ALBANY, N.Y.
400	643.60	ALBANY, N.Y.
410	659.69	ALBANY, N.Y.
420	675.78	ALBANY, N.Y.
430	691.87	ALBANY, N.Y.
440	707.96	ALBANY, N.Y.
450	724.05	ALBANY, N.Y.
460	740.14	ALBANY, N.Y.
470	756.23	ALBANY, N.Y.
480	772.32	ALBANY, N.Y.
490	788.41	ALBANY, N.Y.
500	804.50	ALBANY, N.Y.
510	820.59	ALBANY, N.Y.
520	836.68	ALBANY, N.Y.
530	852.77	ALBANY, N.Y.
540	868.86	ALBANY, N.Y.
550	884.95	ALBANY, N.Y.
560	901.04	ALBANY, N.Y.
570	917.13	ALBANY, N.Y.
580	933.22	ALBANY, N.Y.
590	949.31	ALBANY, N.Y.
600	965.40	ALBANY, N.Y.
610	981.49	ALBANY, N.Y.
620	997.58	ALBANY, N.Y.
630	1013.67	ALBANY, N.Y.
640	1029.76	ALBANY, N.Y.
650	1045.85	ALBANY, N.Y.
660	1061.94	ALBANY, N.Y.
670	1078.03	ALBANY, N.Y.
680	1094.12	ALBANY, N.Y.
690	1110.21	ALBANY, N.Y.
700	1126.30	ALBANY, N.Y.
710	1142.39	ALBANY, N.Y.
720	1158.48	ALBANY, N.Y.
730	1174.57	ALBANY, N.Y.
740	1190.66	ALBANY, N.Y.
750	1206.75	ALBANY, N.Y.
760	1222.84	ALBANY, N.Y.
770	1238.93	ALBANY, N.Y.
780	1255.02	ALBANY, N.Y.
790	1271.11	ALBANY, N.Y.
800	1287.20	ALBANY, N.Y.
810	1303.29	ALBANY, N.Y.
820	1319.38	ALBANY, N.Y.
830	1335.47	ALBANY, N.Y.
840	1351.56	ALBANY, N.Y.
850	1367.65	ALBANY, N.Y.
860	1383.74	ALBANY, N.Y.
870	1399.83	ALBANY, N.Y.
880	1415.92	ALBANY, N.Y.
890	1432.01	ALBANY, N.Y.
900	1448.10	ALBANY, N.Y.
910	1464.19	ALBANY, N.Y.
920	1480.28	ALBANY, N.Y.
930	1496.37	ALBANY, N.Y.
940	1512.46	ALBANY, N.Y.
950	1528.55	ALBANY, N.Y.
960	1544.64	ALBANY, N.Y.
970	1560.73	ALBANY, N.Y.
980	1576.82	ALBANY, N.Y.
990	1592.91	ALBANY, N.Y.
1000	1609.00	ALBANY, N.Y.

## FROM NEW YORK

ENGLISH MILES	METRIC MILES	FROM NEW YORK
10	16.09	ALBANY, N.Y.
20	32.18	ALBANY, N.Y.
30	48.27	ALBANY, N.Y.
40	64.36	ALBANY, N.Y.
50	80.45	ALBANY, N.Y.
60	96.54	ALBANY, N.Y.
70	112.63	ALBANY, N.Y.
80	128.72	ALBANY, N.Y.
90	144.81	ALBANY, N.Y.
100	160.90	ALBANY, N.Y.
110	176.99	ALBANY, N.Y.
120	193.08	ALBANY, N.Y.
130	209.17	ALBANY, N.Y.
140	225.26	ALBANY, N.Y.
150	241.35	ALBANY, N.Y.
160	257.44	ALBANY, N.Y.
170	273.53	ALBANY, N.Y.
180	289.62	ALBANY, N.Y.
190	305.71	ALBANY, N.Y.
200	321.80	ALBANY, N.Y.
210	337.89	ALBANY, N.Y.
220	353.98	ALBANY, N.Y.
230	370.07	ALBANY, N.Y.
240	386.16	ALBANY, N.Y.
250	402.25	ALBANY, N.Y.
260	418.34	ALBANY, N.Y.
270	434.43	ALBANY, N.Y.
280	450.52	ALBANY, N.Y.
290	466.61	ALBANY, N.Y.
300	482.70	ALBANY, N.Y.
310	498.79	ALBANY, N.Y.
320	514.88	ALBANY, N.Y.
330	530.97	ALBANY, N.Y.
340	547.06	ALBANY, N.Y.
350	563.15	ALBANY, N.Y.
360	579.24	ALBANY, N.Y.
370	595.33	ALBANY, N.Y.
380	611.42	ALBANY, N.Y.
390	627.51	ALBANY, N.Y.
400	643.60	ALBANY, N.Y.
410	659.69	ALBANY, N.Y.
420	675.78	ALBANY, N.Y.
430	691.87	ALBANY, N.Y.
440	707.96	ALBANY, N.Y.
450	724.05	ALBANY, N.Y.
460	740.14	ALBANY, N.Y.
470	756.23	ALBANY, N.Y.
480	772.32	ALBANY, N.Y.
490	788.41	ALBANY, N.Y.
500	804.50	ALBANY, N.Y.
510	820.59	ALBANY, N.Y.
520	836.68	ALBANY, N.Y.
530	852.77	ALBANY, N.Y.
540	868.86	ALBANY, N.Y.
550	884.95	ALBANY, N.Y.
560	901.04	ALBANY, N.Y.
570	917.13	ALBANY, N.Y.
580	933.22	ALBANY, N.Y.
590	949.31	ALBANY, N.Y.
600	965.40	ALBANY, N.Y.
610	981.49	ALBANY, N.Y.
620	997.58	ALBANY, N.Y.
630	1013.67	ALBANY, N.Y.
640	1029.76	ALBANY, N.Y.
650	1045.85	ALBANY, N.Y.
660	1061.94	ALBANY, N.Y.
670	1078.03	ALBANY, N.Y.
680	1094.12	ALBANY, N.Y.
690	1110.21	ALBANY, N.Y.
700	1126.30	ALBANY, N.Y.
710	1142.39	ALBANY, N.Y.
720	1158.48	ALBANY, N.Y.
730	1174.57	ALBANY, N.Y.
740	1190.66	ALBANY, N.Y.
750	1206.75	ALBANY, N.Y.
760	1222.84	ALBANY, N.Y.
770	1238.93	ALBANY, N.Y.
780	1255.02	ALBANY, N.Y.
790	1271.11	ALBANY, N.Y.
800	1287.20	ALBANY, N.Y.
810	1303.29	ALBANY, N.Y.
820	1319.38	ALBANY, N.Y.
830	1335.47	ALBANY, N.Y.
840	1351.56	ALBANY, N.Y.
850	1367.65	ALBANY, N.Y.
860	1383.74	ALBANY, N.Y.
870	1399.83	ALBANY, N.Y.
880	1415.92	ALBANY, N.Y.
890	1432.01	ALBANY, N.Y.
900	1448.10	ALBANY, N.Y.
910	1464.19	ALBANY, N.Y.
920	1480.28	ALBANY, N.Y.
930	1496.37	ALBANY, N.Y.
940	1512.46	ALBANY, N.Y.
950	1528.55	ALBANY, N.Y.
960	1544.64	ALBANY, N.Y.
970	1560.73	ALBANY, N.Y.
980	1576.82	ALBANY, N.Y.
990	1592.91	ALBANY, N.Y.
1000	1609.00	ALBANY, N.Y.

## EXPLANATION OF THE TABLE.

In the three triangles headed FROM NEW YORK, is given a list of the representative cities of the world, with their approximate distances from New York, together with their mean annual temperature and average annual rainfall.

## EXPLANATION OF THE TABLE.

In the three triangles headed FROM NEW YORK, is given a list of the representative cities of the world, with their approximate distances from New York, together with their mean annual temperature and average annual rainfall.

## EXPLANATION OF THE TABLE.

In the three triangles headed FROM NEW YORK, is given a list of the representative cities of the world, with their approximate distances from New York, together with their mean annual temperature and average annual rainfall.

## EXPLANATION OF THE TABLE.

In the three triangles headed FROM NEW YORK, is given a list of the representative cities of the world, with their approximate distances from New York, together with their mean annual temperature and average annual rainfall.

## EXPLANATION OF THE TABLE.

In the three triangles headed FROM NEW YORK, is given a list of the representative cities of the world, with their approximate distances from New York, together with their mean annual temperature and average annual rainfall.

PERPETUAL MOONLIGHT CHART.

**To Find the Phase of the Moon for Any Day in Any Year.**—Add the number of the month to the exponent of the required year, and the sum will be the number of the shaded spaces; thus, for July, 1882, 1 (exponent for 1882) added to 7 (number of July) equals 8; in space 8, the First Quarter, as shown by the diagonal lines, is on the 16th; Full Moon on the 30th; Last Quarter on the 1st.



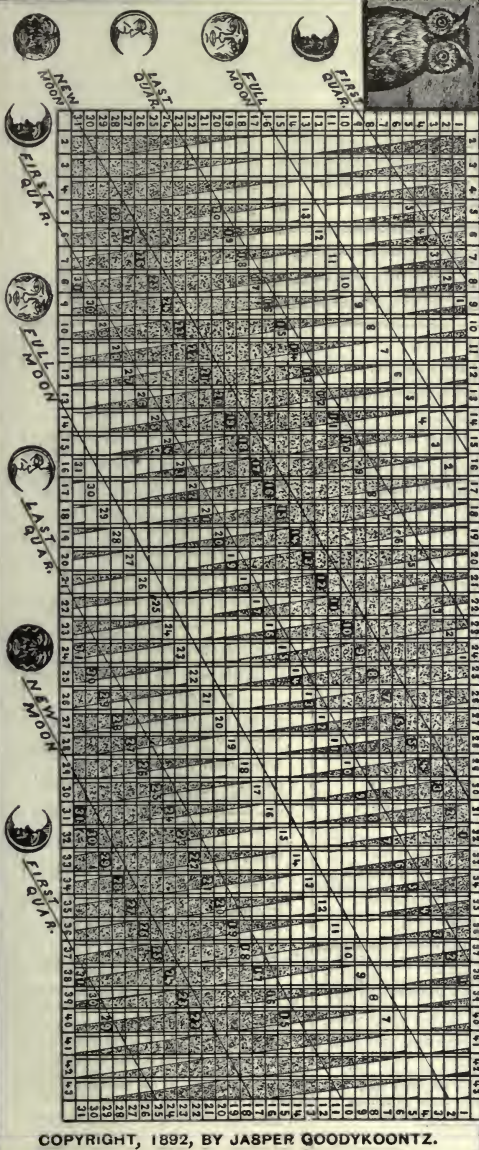
Again on the left.

The numbers at the right and left margins, also those running diagonally across the chart, are the days of the month; those at the top and bottom margins are the numbers of the spaces showing the amount of light and darkness for any month.

Owing to solar and lunar inequalities and the inequalities in the length of the months, the astronomical New Moon may occur one or two days before or after the mean time as shown by the character

# TABLE OF EPACTS FROM THE YEAR 1750 TO THE YEAR 2050.

	1700	1800-4	1900-20	2000-4
50	60.20	60.13	70.0	60.20
51	60.20	60.13	70.0	60.20
52	60.20	60.13	70.0	60.20
53	60.20	60.13	70.0	60.20
54	60.20	60.13	70.0	60.20
55	60.20	60.13	70.0	60.20
56	60.20	60.13	70.0	60.20
57	60.20	60.13	70.0	60.20
58	60.20	60.13	70.0	60.20
59	60.20	60.13	70.0	60.20
60	60.20	60.13	70.0	60.20
61	60.20	60.13	70.0	60.20
62	60.20	60.13	70.0	60.20
63	60.20	60.13	70.0	60.20
64	60.20	60.13	70.0	60.20
65	60.20	60.13	70.0	60.20
66	60.20	60.13	70.0	60.20
67	60.20	60.13	70.0	60.20
68	60.20	60.13	70.0	60.20
69	60.20	60.13	70.0	60.20
70	60.20	60.13	70.0	60.20
71	60.20	60.13	70.0	60.20
72	60.20	60.13	70.0	60.20
73	60.20	60.13	70.0	60.20
74	60.20	60.13	70.0	60.20
75	60.20	60.13	70.0	60.20
76	60.20	60.13	70.0	60.20
77	60.20	60.13	70.0	60.20
78	60.20	60.13	70.0	60.20
79	60.20	60.13	70.0	60.20
80	60.20	60.13	70.0	60.20
81	60.20	60.13	70.0	60.20
82	60.20	60.13	70.0	60.20
83	60.20	60.13	70.0	60.20
84	60.20	60.13	70.0	60.20
85	60.20	60.13	70.0	60.20
86	60.20	60.13	70.0	60.20
87	60.20	60.13	70.0	60.20
88	60.20	60.13	70.0	60.20
89	60.20	60.13	70.0	60.20
90	60.20	60.13	70.0	60.20
91	60.20	60.13	70.0	60.20
92	60.20	60.13	70.0	60.20
93	60.20	60.13	70.0	60.20
94	60.20	60.13	70.0	60.20
95	60.20	60.13	70.0	60.20
96	60.20	60.13	70.0	60.20
97	60.20	60.13	70.0	60.20
98	60.20	60.13	70.0	60.20
99	60.20	60.13	70.0	60.20
100	60.20	60.13	70.0	60.20







## ADVICE.

"Desire not to live long, but to live well;  
How long we live, not years, but actions tell."

"Press on! our life is not a dream,  
Though often such its mazes seem;  
We were not born to live at ease,  
Ourselves alone to aid and please."

"As you travel through life, scatter words  
and gentle deeds; in so doing you will  
enrich your soul. Withhold them and  
it tends to poverty."

"Give every man thine ear, but few thy voices;  
Take each man's censure, but reserve thy judgment."

"Know when to speak—for many times it brings  
Danger, to give the best advice to kings."

"Fear not the anger of the wise to raise;  
Those best can bear reproof who merit praise."

"I find, quoth Mak, reproof is vain!  
Who first offend will first complain."

"Good advice is one of those injuries which  
a good man ought, if possible, to forgive, but  
at all events to forget at once."

## AFFECTION.

"When the golden sun is setting,  
And your heart from care is free,  
When o'er a thousand things you're thinking  
Will you sometimes think of me!"

"Years have not seen—time shall not see  
The hour that tears my soul from thee."

"There are moments of mingled sorrow  
and tenderness, which hallow the caresses  
of affection."

"When years and months have glided by,  
And on this page you cast your eye,  
Remember 'twas a friend sincere  
That left this kind remembrance here,  
With best wishes for your future cheer."

"There are few mortals so insensible that  
their affections cannot be gained by mild-  
ness, their confidence by sincerity, their  
hatred by scorn or neglect."

"Passing through life's field of action,  
Lest we part before its end,  
Take within your modest volume  
This memento from a friend."

"Hearts may be attracted by assumed qual-  
ities, but the affections are only to be fix-  
ed by those that are real."

"We seek what we love; our efforts fol-  
low our affections, whether we know it  
or not."

## BIRTHDAY.

"I wish thee every blessing  
That can attend thee here;  
And may each future birthday prove  
My wish to be sincere."

"My birthday!—How many years ago!  
Twenty or thirty?" Don't ask me!  
"Forty or fifty!" How can I tell?  
I do not remember my birth, you see!"

"Little trouble and still less care,  
With ever a faithful heart to share;  
Birthdays many, and happy too,  
This is the life I wish for you."

"Is that a birthday! 'tis, alas! too clear,  
'Tis but the funeral of the former year."

"As beautiful flowers in garlands interwine,  
May peace and love to cheer thy heart combine  
To give you a very happy birthday!"

"May these flowers, presented on your birth-  
day be emblematical of the purity of your life."

"May Spring its blossoms round thee strew,  
And Summer, deck'd in mantle new,  
Come forth to greet thee;

May Autumn fruitage crown the year,  
And Winter, with its jovial cheer,  
Bring friends to meet thee."

"Like sunbeams to the drooping flowers,  
Good-will our lives doth bless;  
It furthers every wish of ours,  
And joys in our success."

So may its rays towards you flow,  
That none but friends your heart may know!

Lovingly take this birthday souvenir,  
And for my sake esteem it dear!

"May the morn of thy birth break in glad-  
ness, and the day teem with light-hearted  
mirth that shall last always."

## CHRISTMAS.

"True love shall live thro' sorrow's wintry storm,  
And bloom afresh on this glad Christmas morn."

"Christ-mas is coming, and what will it bring?  
Many a pleasure and gladdening thing!  
Meetings and greetings, and innocent mirth:  
All that is brightest and best on the earth."

"As Christmas offerings meet your eyes,  
Still closer be sweet friendship's ties."

"Oh joyous be your Christmas-tide,  
And bring your New Year too;  
To you may love ne'er be denied;  
May all your friends be true."

Be of good cheer, for Christmas comes but once a year.

"Oh! may thy Christmas happy be,  
And naught but joy appear,  
Is now the wish I send to thee,  
And all I love most dear."

"Oh bird so softly singing  
Your song of pleasant days,  
Go sing to her I fondly love,  
Through the wintry cold and bare.  
When the heart is light, the days are bright,  
And the sun seems ever near,  
So sing her your lay this Christmas day,  
And through all the bright New Year."

"Now Christmas comes with hearty cheer,  
May kindly thoughts go round,  
And bring to you a glad New Year,  
With peace and plenty crowned."

"Christmas comes, let every heart  
In Christmas customs bear a part  
The 'old' be 'young,' the sad be gay,  
And smiles chase every care away."

"May health and joy, and peace be thine  
Upon this Christmas day,  
And happy faces round thee shine  
As plentiful as the flowers in May."

## FRIENDSHIP.

"On the broad highway of action,  
Friends of worth are rare and few,  
But when one has proved her friendship,  
Cling to her who clings to you."

"There are few friends in this wide world  
Whose love is fond and true;  
But—when you count them o'er,  
Place me among the few."

"In future years, should trusted friends  
Depart like summer birds,  
And all the comfort memory lends,  
Is false and homeyed words,  
Turn them to me who faith would prove,  
However thy lot be cast,  
That naught his heart can ever move  
From friendship of the past."

"In the evening of life, cherish the remem-  
brance of one who loved thee in its morning."

"Let not our friendship be like the rose, to wither,  
But, like the evergreen, may it last forever."

"A day for toil, an hour for sport,  
But for a friend life is too short."

"Thick waters show no images of things;  
Friends are each other's mirrors, and should be  
Clearer than crystal, or the mountain-springs,  
And free from clouds, design, or flattery."

"A generous friendship 'till cold medium knows,  
It burns with one love, with one repentment glows."

# THE ALBUM WRITER'S DEPARTMENT—CONTINUED.

## HUMOROUS.

"Sailing down the stream of life,  
In your little bark canoe,  
May you have a pleasant trip,  
With just toon enough for two."

"Man may be happy, if he will,  
I've said it often, and I think so still;  
Roses may smooth life's journey, and adorn;  
But thou hast full leave to tread upon a thorn."

"Dread fevers burn, and ague freezes,  
Rheumatics gnaw, and colic squeezes;  
But thou, toothache, surely bearest the bell,  
And hast thy place with the priests of hell."

"The world is full of fools,  
An he who would none view  
Must shut himself in a cave,  
And break his mirror too."

"Your arithmetic only can trip,  
When to kiss and to count you endeavor;  
But eloquence glows on your lip,  
When you swear that you'll love me forever."

"Come, gentle Spring! eternal goodness, come!  
O! Thompson, vol of rhyme as well as reason,  
How couldst thou thus poor human nature harm!  
There's no such season,  
The Spring! I shrink and shudder at her name!  
For why, I find her breath a bitter blighter!  
And suffer from her blows as if they came.  
From Spring the fighter."

"May your cheeks retain their dimples,  
May your heart be just as gay,  
Until some manly voice shall whisper,  
'Dearest, will you name the day?'"

"I care not much for gold or land,  
Give me a mortgage here and there,  
Some good bank stock—some note of hand,  
Or trifling railroad share,  
I only ask that Fortune send  
A little more than I can spend."

"A long life, and a happy one;  
A tall man, and a jolly one;  
Like—well—you know who!"

## LOVE.

"Love me little, love me long,  
Do not flit, for it is wrong."

"The heart that has truly loved never forgets,  
But as truly loves on to the close."

"I bring motifs of passion; I breathe no tone of love,  
But the freshness and the purity of a feeling far above;  
I love to turn to thee, fair girl, as one within whose heart  
Earth hath no stain of vanity, and fickleness no part."

"Dost thou know, love, that thy smile  
Makes the whole world bright for me?  
Just as sunrise pursers a sudden  
Purple glory on the sea.  
Ah! had I that power, ever  
Should the world look bright to thee."

"When words we want, love teacheth to indite;  
And what we blush to speak, she bids us write."

"Rank is good, and gold is fair,  
And high and low make ill;  
But love has never known a law  
Beyond its own sweet will."

"Love, life's fine centre, includes heart and mind."

## MARRIAGE.

"Precious and lovely, I yield her to thee;  
Take her, the gem of thy dwelling to be.  
She who was ever my solace and pride,  
Flees from my bosom to cling to thy side."

"There's a bliss beyond all that minstrel has told,  
When two that are linked in one heavenly fold,  
With heart never changing, and how never cold,  
Love on through all ill, and low still they die."

"Wedlock's a saucy, sad, familiar state,  
Where folks are very, very to sell and to hate.  
Love keeps a modest distance, is divine,  
Obliging, and says ev'ry thing that's fine."

"Mises! the tale that I relate  
This lesson seems to carry—  
Choose not alone a proper mate,  
But proper time to marry."

"Marriage from love, like vinegar from wine—  
A sad, sour, sober beverage—by time  
Is sharpened from its high celestial flavor  
Down to a very homely household savor."

## NEW YEAR.

"On this New Year's morning  
My wishes take their flight,  
And wing to thee a greeting  
That would make all things bright."

"We cannot look into the future,  
We cannot tell if the New Year  
Will bring us fresh sorrows to mourn  
Or bring us fresh blessings to cheer."

"For friends we strive to pierce  
The future, dense and dark,  
But not a ray of light  
We see, nor faintest spark;  
But yet while we have faith to cheer,  
We trusting wish 'A bright New Year.'"

"O childhood is a golden time,  
When all the world is bright,  
When sunshine comes with every morn,  
Sweet dreams with every night.  
Were I a fairy, I would give  
To thee a magic kiss,  
That should ensure for the New Year,  
As fair a time as this."

"Health and prosperity  
Your life to cheer,  
With every blessing  
For the bright New Year."

## SENTIMENT.

"One port, methinks, alike we seek,  
One purpose hold where'er we fate;  
O bounding breeze, O rushing seas,  
At last, at last unite us there."

"Full many a gem of purest ray serene  
The dark unfathomed caves of ocean bear;  
Full many a flower is born to blush unseen,  
And waste its sweetness on the desert air."

"When the name I write here is dim on the page,  
And the leaves of your album are yellow with age,  
Still think of me kindly, and do not forget  
That, wherever I am, I remember you yet."

"The massive gates of circumstance  
Are turned upon the slightest hinge,  
And thus some seeming petty chance,  
Off gives to life its after thing."

## THANKSGIVING.

"Thanksgiving-Day again is here,  
And Turkey is the leading question;  
I wish, with heartiness sincere,  
That you may have good digestion."

"There is a kind of gratitude in thanks,  
Though it be barren, and bring forth but words."

## TIME.

"Hours are golden links—God's token—  
Reaching heaven, but one by one;  
Take them, lest the chain be broken  
Ere thy pilgrimage be done."

"We should count time by heart-throbs; he  
Most lives who thinks most, speaks the most  
Best, acts the best."

"Lost, yesterday, somewhere between sun-  
rise and sunset, two golden hours, each  
set with sixty diamond minutes. No reward  
offered, for they are gone forever."

"The lapse of time and rivers is the same;  
Both speed their journey with a restless shame;  
The silent pace with which they steal away,  
No wealth can bribe, no prayers persuade to stay."

"May the morn of thy life be bright and  
joyous, the noontide peaceful and happy,  
and the sunset gloriously hopeful, is the  
wish of your friend."

## TITLE PAGE.

"Precious book of charming place,  
Gems of thought may here be cast,  
Names that time may not erase,  
Pleasant memories of the past."

"Do forth thou little volume,  
I leave thee to thy fate;  
To love and friendship truly,  
Thy leaves to dedicate."

"Go, little book, thy destined course pursue,  
O'erleaves of the past and true,  
And beg of every friend so near  
Some token of remembrance dear."

"My best friends, there is an Album  
Full of leaves of snowy white,  
Where no name is ever tarnished,  
But forever pure and bright.  
In that Book of Life, God's Album,  
May your name be penned with mine;  
And may all who hereon write,  
Have their names forever thine."

## WELL WISHES.

"May God's mercy ever guide thee,  
Safe o'er all thy thorny road;  
And His grace, what'er be the thee,  
Lead thee home to His abode."

"May your life be like the snowflake, which  
leaves a mark, but not a stain."

"May happiness ever be thy lot,  
Wherever thou shalt be;  
And joy and pleasure light the spot  
That may be home to thee."

"May Heaven on you its choicest blessings shower,  
Is the sincere wish of your friend."

"Roses, without thorns, for thee."

"May your days in joy be passed  
With friends to bless and cheer;  
And each year exceed the last  
In all that earth holds dear."

"May Fortune with her kindest smile,  
Wreath laurels for thy brow;  
May loving angels guard and keep thee  
Ever pure as thou art now."

"May He who hath pencilled the leaves with  
beauty, given the flowers their bloom, and  
lent music to the lay of the timid bird,  
graciously remember thee in that day  
when He shall gather His jewels."

"May the chain of friendship formed  
by the links which are dropped here, unite  
you more closely in spirit with the  
friends who have worked it."



# BEWARE MAN!

As you are now,  
so once was I;  
As I am now,  
you soon shall be.  
Sooner or later,  
herein you'll lie;  
Then be prepared  
to follow me.



# IN THE CEMETERY.

Must Jesus bear  
the cross alone,  
And all the world  
go free?  
No; there's a cross  
for every one,  
And there's a cross  
for me.

The consecrated cross  
I'll bear  
Till death shall set  
me free,  
And then go home  
my crown to wear—  
For there's a crown  
for me.

## Minnie.

"She falt-  
ered by the  
wayside, and the  
Angels took  
her home."

## Our Mother.

Died May 3, 1916.  
AGED 70 YEARS.

## LILLIE,

Infant daughter of  
E. & C. MOORE,  
— DIED —  
Oct. 1, 1911. Aged 3 Mos.  
"Beneath this stone,  
in soft repose,  
is laid a mother's  
dearest prize;  
A flower that scarce  
had waked to life  
And light and beauty,  
ere it died."

SACRED  
TO THE MEMORY OF  
H. M. SMITH,  
WHO DEPARTED THIS  
LIFE

August 13, 1917.  
Aged 63 Years.

"Dying is but  
going home."

## LITTLE EDDY,

— DIED —  
October 10, 1917.  
Aged 5Yrs 9M's.

" 'Tis a little grave,  
but O, have care,  
For world-wide hopes  
are buried there;  
How much of light,  
how much of joy,  
is buried with a  
darling boy."



## ANDREW WOOD,

December 19, 1917.  
Aged 36 Years.

## LENA WEST,

ENTERED SPIRIT LIFE  
October 27, 1947.  
Aged 21Yrs, 3M's.

"O land beyond the  
selling sun!  
O realm more fair  
than poets dream!  
How clear thy silvery  
streamlets run,  
How bright thy golden  
glories gleam!"

## Rev. H. Marx,

BORN,  
November 4, 1893.  
DIED,  
December 19, 1951.

He died as he lived  
— a Christian.

## CHARLIE:

The Angels called  
him on a sun-  
ny day,  
September 3, 1933.  
AGED 4Yrs, 3M's, 6D's.  
"This lovely bud,  
so young, so fair,  
Called hence by  
early doom,  
Just came to show  
how sweet a flower  
In Paradise would  
bloom."

## MARION,

Husband of  
E. E. Stephenson.  
Born Oct. 1, 1907.  
Died May 3, 1971.

"Heaven's  
eternal year is  
thine."

STEPHENSON.

## ETTA EVAN,

WIFE OF  
H. H. MARSH.

Aged 41 Years.  
November 1, 1937.

"Where immortal  
spirits reign,  
There we shall  
meet again."



## DAVID D. PORTER

Admiral U.S.N.  
Died Feb. 13, 1891.  
Aged 79 Years.

## Edward M.,

SON OF  
M. & H. MORE.  
— DIED —  
March 17, 1941.  
Aged 17Yrs, 3M's.

## H. J. BELDEN,

CAPT. OF  
51st Regiment  
Ill. Volunteers,  
Killed at the Battle  
of Perryville,  
October 8, 1864.  
Aged 51Yrs, 6M's, 10D's.



## R. M. HANCOCK,

— DIED —  
February 7, 1899.  
Aged  
59Yrs, 3M's, 4D's.

## MABEL B. HUNT,

BORN INTO SUMMER LAND  
September 1, 1927.  
Aged 19Yrs, 7M's.

"Amiable.  
she won all;  
Intelligent, she  
charmed all; fervent,  
she loved all;  
and dead, she  
saddened  
all."

## ABRAHAM LINCOLN,

Sixteenth  
President of the  
United States,  
Born  
February 12, 1809.  
Died  
April 15, 1865.

# IN THE CEMETERY, CONTINUED.

## EPITAPHS

Epitaphs should be condensed into a few words, usually not more than four lines. Following is a classified list.

### INFANTS.

"Happy infant, early blest!  
Rest in peaceful slumbers, rest."

"Sweet flower, transplanted to a clime  
Where never comes the blight of time"

"To us for sixteen anxious months,  
His infant smile was given,  
And then he bade farewell to earth  
And went to live in heaven."

"Ere sin could blight, or sorrow fade;  
Death came with friendly care;  
The opening bud to heav'n conveyed,  
And bade it blossom there."

### CHILDREN.

Gentle, Sweet little \_\_\_\_\_  
Charlie.

"We shall all go home to our Father's house,  
To our Father's house in the skies,  
Where the hope of our souls shall have no blight,  
And our love no broken ties  
We shall roam on the banks of the River of Peace,  
And bathe in its blissful tide;  
And one of the joys of our heaven shall be  
The little boy that died."

"Suffer little children to come unto me."

"There, in the Shepherd's bosom,  
White as the drifted snow,  
Is the little lamb we missed one morn,  
From the household flock below."

"Of such is the kingdom of Heaven."

"My Lord hath need of these flow'rets gay,"  
The Reaper said, and smiled;

"Dear tokens of the earth are they,  
Where He was once a child."

"The morning flowers display their sweets,  
And gay their silken leaves unfold;  
As careless of the noonday heats,  
And fearless of the evening cold.  
Nipped by the wind's unkindly blast,  
Perch'd by the sun's directer ray,  
The momentary glories waste,  
The short-lived beauties die away."

### PARENTS.

Father

Our Mother.

"In after Time we'll meet Her."

"Her children rise up and call her blessed."

"We loved Her."

"Sweet is the image of the brooding dove;  
Holy as heaven is a mother's tender love.  
Soon did these eyes their trembling lids close,  
And welcomed the dreamless night to long repose."

"I know his face is hid—Under the coffin lid;  
Closed are his eyes; Cold is his forehead fair.  
My hand that marble felt—O'er it in prayer I kneel;  
Yet my heart whispers that—he is not here."

### SISTER.

Darling Sister.

"Rest, Darling Sister, Rest."

"Yet, though thou wearst the glory of the sky,  
We know thou'lt keep the same beloved name;  
The same fair, thoughtful brow and gentle eye,  
Lovlier in heaven's sweet climate, yet the same."

"Shed not for her the bitter tear,  
Nor give the heart to vain regret,  
'Tis but the casket that lies here,  
The gem that filled it sparkles yet."

"She was but as a smile,  
Which glistens in a tear,  
Seem but a little while,  
But, oh! how loved, how dear!"

"Death lies on her, like an untimely frost  
Upon the sweetest flower of all the field."

"Early, bright, transient, chaste as morning dew,  
She sparkled, was exhal'd, and went to heaven."

"The day without a cloud hath pass'd,  
And thou wert lovely to the last;  
Extinguish'd, not decay'd!  
As stars that shoot along the sky  
Shine brightest as they fall from high!"

### BROTHER.

"We saw not the Angels who met him there,  
The gates of the city we could not see.  
Over the river, over the river,  
My darling stands waiting to welcome me."

"So the bird of my bosom fluttered up to the dawn,  
A window was opened—my darling was gone!  
A truant from time, from tears, and from sin,  
For the angel on watch took the wanderer in!"

"From meadows fan'd by heaven's life-breathing wind,  
In the residence of that glorious sphere,  
And larger movements of the unfettered mind,  
Come darling, oft, and meet me here."

"Death loves a shining mark."

"Death is the gate of life."

"Come before us, O our brother,  
To the spirit land!  
Vainly look we for another,  
In thy place to stand."

"Known and unknown, human, divine,  
Sweet darling hand, and lips and eyes;  
Dear heavenly one, thou canst not die,  
Mine, mine forever, ever mine."

### CHRISTIANS.

"Christ is my hope."

"There shall be no Night there."

"He carries the lambs in his bosom."

"I love them that love me, and they that seek  
me early shall find me."

"Judge not the Lord by feeble sense,  
But trust Him for His grace;  
Behind a frowning providence,  
He hides a smiling face."

"Not thus his nobler part shall dwell  
A prisoner in his narrow cells,  
But he, whom we now hide from men,  
With youth renewed, shall live again."

"Though I walk through the valley of the  
shadow of death, I will fear no evil,  
For Thou art with me."

"Thy rod and Thy staff, they comfort me."

"Sweet is the scene when virtue dies!  
When sinks a righteous soul to rest,  
How mildly beam the closing eyes,  
How gently heaves the expanding breast!"

"Here I lay my burden down,  
Change the cross into the crown."

"I shall know the loved who have gone before,  
And joyfully sweet will the meeting be,  
When over the river, the peaceful river,  
The angel of death shall carry me."

"Because I lived, ye shall live also."

"Dear is the spot where Christians sleep,  
And sweet the strains that angels pour.  
O! why should we in anguish weep?  
They are not lost, but gone before."

"I am the resurrection and the life."

"Life's duty done, as sinks the day,  
Light from his load the spirit flies;  
While heaven and earth combine to say,  
How blest the righteous when he dies."

"He giveth his beloved sleep."

### MISCELLANEOUS.

"Green be the turf above thee,  
Friend of my better days;  
None knew thee but to love thee,  
Nor named thee but to praise."

"By foreign hands thy dying eyes were clos'd,  
By foreign hands thy decent limbs compos'd,  
By foreign hands thy humble grave adorn'd,  
By strangers honor'd, and by strangers mourn'd."

"All is Well."

"We will Meet again."

"Over in the Summer Land"

"Farewell to thee, my house of clay!  
Long have we two been bound together,  
I forsake thy porch to-day,  
And yield thee up to wind and weather.  
Sleep, sleep at last! thy sleep shall be  
My rest, my strength, my victory."

"Absent, not Dead."

"Rest in peace, thou gentle spirit,  
Throned above the lowly grave;  
Souls like thine with God inherit  
Love and love."

"Come Home."

"Death, thou art but another birth,  
Freeing the spirit from the clogs of earth."

"O Death! where is thy sting? O Grave!  
where is thy victory!"

"Gone, but not forgotten."

"A happier lot than ours, and larger light  
surrounds thee there."

"Life is real, life is earnest,  
And the grave is not its goal;  
'Dust thou art, to dust returnest,  
Was not spoken of the soul."

"We only know that thou hast gone,  
And that the same returnless tide,  
Which bore thee from us, still glides on,  
And we, who mourn thee, with it glide."

"The Morning Cometh."

"Where immortal spirits reign,  
There we shall meet again."

"The sands are numbered that made up my life."

"The boast of heraldry, the pomp of power,  
And all that beauty, and all that wealth ergave,  
Await alike the inevitable hour,  
The paths of glory lead but to the grave."

"Good-bye, proud world! I'm going home,  
Thou art not my friend, and I'm not thine."

"Sleep the sleep that knows no breaking,  
Morn of toil, nor night of waking."

"Death is only kind to mortals."





# N INSTANTANEOUS METHOD OF MEASURING LUMBER



In the table, Board and Plank Measurement, the length is given at the top; the width at the left, and also in the body of the table. If the dimensions of any board exceed the dimensions given in the table, take any two dimensions, and add. To find the feet in a board, take the length at the top, and descend the column to the required width (shown by the small back-hand number), where is found the number of feet and inches. In the other tables, fractions of a foot are dropped if less than  $\frac{1}{4}$ ; added if more.

## BOARD AND PLANK MEASUREMENT

LENGTH IN FEET.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
3 INCHES WIDE	1 00	1 03	1 06	1 09	2 00	2 03	2 06	2 09	3 00	3 03	3 06	3 09	4 00	4 03	4 06	4 09	5 00	5 03	5 06
4 INCHES WIDE	1 04	1 08	2 00	2 04	2 08	3 00	3 04	3 08	4 00	4 04	4 08	5 00	5 04	5 08	6 00	6 04	6 08	7 00	7 04
5 INCHES WIDE	1 08	2 01	2 06	2 11	3 04	3 09	4 02	4 07	5 00	5 05	5 10	6 03	6 08	7 01	7 06	7 11	8 04	8 09	9 02
6 INCHES WIDE	2 00	2 06	3 00	3 06	4 00	4 06	5 00	5 06	6 00	6 06	7 00	7 06	8 00	8 06	9 00	9 06	10 00	10 06	11 00
7 INCHES WIDE	2 04	2 11	3 06	4 01	4 08	5 03	5 10	6 05	7 00	7 07	8 02	8 09	9 04	9 11	10 06	10 11	11 06	11 12	12 06
8 INCHES WIDE	2 08	2 04	4 00	4 08	5 04	6 00	6 08	7 04	8 00	8 08	9 04	10 00	10 08	11 04	12 00	12 08	13 04	14 00	14 08
9 INCHES WIDE	3 00	3 09	4 06	5 03	6 00	6 09	7 06	8 03	9 00	9 09	10 06	11 03	12 00	12 09	13 06	14 03	15 00	16 00	16 06
10 INCHES WIDE	3 04	4 02	5 06	5 10	6 08	7 06	8 04	9 02	10 00	10 11	11 08	12 06	13 04	14 02	15 01	16 01	17 01	18 01	19 01
11 INCHES WIDE	3 08	4 07	5 08	6 05	7 04	8 03	9 02	10 01	11 01	11 12	12 13	13 14	14 15	15 16	16 17	17 18	18 19	19 20	20 20
12 INCHES WIDE	4 00	5 00	6 00	7 00	8 00	9 00	10 00	11 00	12 00	13 00	14 00	15 00	16 00	17 00	18 00	19 00	20 00	21 00	22 00
13 INCHES WIDE	4 04	5 05	6 06	7 07	8 08	9 09	10 10	11 11	12 12	13 13	14 14	15 15	16 16	17 17	18 18	19 19	20 20	21 21	22 22
14 INCHES WIDE	4 08	5 10	7 00	8 02	9 04	10 06	11 08	12 10	13 12	14 14	15 16	16 18	17 20	18 22	19 24	20 26	21 28	22 30	23 32
15 INCHES WIDE	5 00	6 03	7 06	8 09	9 10	10 11	11 12	12 13	13 15	14 16	15 18	16 20	17 22	18 24	19 26	20 28	21 30	22 32	23 34
16 INCHES WIDE	5 04	6 06	8 00	9 04	10 08	11 12	12 16	13 20	14 24	15 28	16 32	17 36	18 40	19 44	20 48	21 52	22 56	23 60	24 64
17 INCHES WIDE	5 08	7 01	8 06	9 11	10 16	11 21	12 26	13 31	14 36	15 41	16 46	17 51	18 56	19 61	20 66	21 71	22 76	23 81	24 86
18 INCHES WIDE	6 00	7 06	9 00	10 06	11 12	12 18	13 24	14 30	15 36	16 42	17 48	18 54	19 60	20 66	21 72	22 78	23 84	24 90	25 96
19 INCHES WIDE	6 04	7 11	9 06	10 12	11 18	12 24	13 30	14 36	15 42	16 48	17 54	19 00	20 06	21 12	22 18	23 24	24 30	25 36	26 42
20 INCHES WIDE	6 08	8 04	10 00	11 06	12 12	13 18	14 24	15 30	16 36	17 42	18 48	19 54	21 00	22 06	23 12	24 18	25 24	26 30	27 36
21 INCHES WIDE	7 00	8 09	10 06	11 14	12 21	13 28	14 35	15 42	16 49	17 56	19 03	20 10	21 17	22 24	23 31	24 38	25 45	26 52	27 59
22 INCHES WIDE	7 04	9 02	11 01	12 10	13 19	14 28	15 37	16 46	17 55	19 04	20 13	21 22	22 31	23 40	24 49	25 58	26 67	27 76	28 85
23 INCHES WIDE	7 08	9 07	11 06	12 15	13 24	14 33	15 42	16 51	18 00	19 09	20 18	21 27	22 36	23 45	24 54	25 63	26 72	27 81	28 90
24 INCHES WIDE	8 00	10 00	12 00	14 00	16 00	18 00	20 00	22 00	24 00	26 00	28 00	30 00	32 00	34 00	36 00	38 00	40 00	42 00	44 00
25 INCHES WIDE	8 04	10 04	12 04	14 04	16 04	18 04	20 04	22 04	24 04	26 04	28 04	30 04	32 04	34 04	36 04	38 04	40 04	42 04	44 04
26 INCHES WIDE	8 08	10 08	12 08	14 08	16 08	18 08	20 08	22 08	24 08	26 08	28 08	30 08	32 08	34 08	36 08	38 08	40 08	42 08	44 08
27 INCHES WIDE	8 12	10 12	12 12	14 12	16 12	18 12	20 12	22 12	24 12	26 12	28 12	30 12	32 12	34 12	36 12	38 12	40 12	42 12	44 12
28 INCHES WIDE	8 16	10 16	12 16	14 16	16 16	18 16	20 16	22 16	24 16	26 16	28 16	30 16	32 16	34 16	36 16	38 16	40 16	42 16	44 16
29 INCHES WIDE	9 00	11 00	13 00	15 00	17 00	19 00	21 00	23 00	25 00	27 00	29 00	31 00	33 00	35 00	37 00	39 00	41 00	43 00	45 00
30 INCHES WIDE	9 04	11 04	13 04	15 04	17 04	19 04	21 04	23 04	25 04	27 04	29 04	31 04	33 04	35 04	37 04	39 04	41 04	43 04	45 04
31 INCHES WIDE	9 08	11 08	13 08	15 08	17 08	19 08	21 08	23 08	25 08	27 08	29 08	31 08	33 08	35 08	37 08	39 08	41 08	43 08	45 08
32 INCHES WIDE	10 00	12 00	14 00	16 00	18 00	20 00	22 00	24 00	26 00	28 00	30 00	32 00	34 00	36 00	38 00	40 00	42 00	44 00	46 00

## LOGS REDUCED TO BOARD MEASURE

	DIAM.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
10 FEET LONG	23	31	40	50	62	75	90	105	122	140	160	180	202	225	250	275	302	330	360	391	422	456	490	526	562	600
11 FEET LONG	25	34	44	55	68	83	99	116	135	154	175	196	219	243	268	295	323	353	384	416	450	486	523	561	599	638
12 FEET LONG	27	37	48	61	75	91	109	128	147	169	192	217	243	271	300	331	363	397	431	467	504	542	581	621	661	701
13 FEET LONG	29	40	52	66	81	98	117	137	159	183	208	235	263	293	325	359	393	430	468	508	549	592	637	684	731	778
14 FEET LONG	32	43	56	71	88	108	128	151	177	204	233	263	293	325	359	396	434	473	514	557	601	646	693	741	789	837
15 FEET LONG	34	46	60	76	94	115	137	161	189	219	250	282	315	350	387	426	466	508	551	596	642	689	737	786	835	884
16 FEET LONG	36	49	64	81	100	121	144	169	196	225	258	293	328	365	404	444	486	530	576	623	671	720	770	820	870	920
17 FEET LONG	39	52	68	86	106	128	153	179	208	239	272	307	344	383	423	465	510	557	605	654	704	754	804	854	904	954
18 FEET LONG	41	55	72	91	112	136	162	190	220	253	288	325	364	404	446	491	538	586	636	686	737	787	838	888	938	988
19 FEET LONG	43	58	76	96	119	143	171	201	232	267	304	343	384	426	471	518	567	617	668	719	770	821	872	923	974	1024
20 FEET LONG	46	61	80	101	125	151	180	211	244	280	320	361	404	448	495	545	596	647	699	751	803	855	907	959	1011	1063
21 FEET LONG	49	64	84	106	131	158	189	222	257	295	336	379	425	473	523	574	626	678	730	782	834	886	938	990	1042	1094
22 FEET LONG	50	67	88	111	137	166	198	232	269	309	352	397	445	495	546	598	651	704	757	810	863	916	969	1022	1075	1128
23 FEET LONG	52	70	92	116	144	174	207	243	281	323	368	415	465	517	570	623	676	730	783	836	889	942	995	1048	1101	1154
24 FEET LONG	54	73	96	121	151	182	216	254	294	338	384	432	482	535	589	643	697	751	804	857	910	963	1016	1069	1122	1175
25 FEET LONG	56	77	100	127	158	190	225	264	306	351	400	451	503	556	610	664	718	771	824	877	930	983	1036	1089	1142	1195
26 FEET LONG	59	80	104	132	165	198	234	274	318	366	416	470	524	578	632	686	740	793	846	899	952	1005	1058	1111	1164	1217
27 FEET LONG	61	83	108	137	171	205	243	285	330	380	432	486	540	594	648	702	756	809	862	915	968	1021	1074	1127	1180	1233
28 FEET LONG	63	86	112	142	177	212	250	293	342	394	448	502	556	610	664	718	772	825	878	931	984	1037	1090	1143	1196	1249
29 FEET LONG	65	89	116	147	182	219	261	306	356	409	464	518	572	626	680	734	788	841	894	947	1000	1053	1106	1159	1212	1265
30 FEET LONG	68	92	120	152	189	228	270	316	368	422	480	534	588	642	696	750	804	857	910	963	1016	1069	1122	1175	1228	1281
31 FEET LONG	70	95	124	157	193	234	279	327	380	436	496	552	607	662	716	770	824	877	931	984	1037	1090	1143	1196	1249	1302



## LOGS REDUCED TO CUBIC FEET

[illegible]

SCANTLING AND TIMBER MEASUREMENT

## THICKNESS AND WIDTH IN INCHES

[illegible]

## THICKNESS AND WIDTH IN INCHES

[illegible]





# Business Correspondence



The chief requisites of a business letter are clearness, conciseness and explicitness. There should be nothing defective, superfluous, or ambiguous. In replying to a letter take up the different items and answer them in the same order as they are contained therein. The correspondent should be familiar with the wants of his customer and the details of the business he represents. It is a point of very great importance that all orders given be clear and explicit. Every letter should speak, as it were, for itself, and give all the necessary particulars of the transaction to which it refers.

## ORDERING BOOKS.

Perry, Ind., Nov. 1, 19--.

Messrs. Conway, Logan & Co.,  
671 Market St., Chicago.

Gentlemen:—Please forward to my address, by express, the following:

1 copy Spurgeon's Sermons . . . . .	\$2.00
1 " Webster's Academic Dictionary . . .	2.50
1 " Pilgrim's Progress . . . . .	1.25
1 " The Golden Dawn . . . . .	3.50
1 " Soul's Synonyms . . . . .	2.00
	\$11.25

For which I enclose money order.

Very respectfully,  
W. H. KNAUSE.

## 2. ORDERING DRY-GOODS.

Jacksonville, Fla., May 1, 19--.  
Messrs. Brown & Howard,  
New York.

Gentlemen:—Please send me, by express, the following:

2 Lancaster Spreads (\$3.50) . . . . .	\$7.00
3 doz. Napkins . . . . .	9.00
12 yds. Calico, white with pink dot (25c) .	3.00
12 " " blue " " . . . . .	3.00
1 fine Lady's hem-stitched Handkerchief .	1.00
4 pairs Lady's Cotton Hosiery (50c) . . . .	2.00
	\$25.00

Collect on delivery.

Yours truly,  
J. K. ARMSTRONG.

## 3. ORDER TO A CLOTHIER.

Gellysburg, Pa., Sept. 9, 19--.  
Messrs. Walters & Co.  
Detroit, Mich.

Gentlemen:—Please send me by express, C.O.D.,

one all wool suit, for boy ten years of age, to cost about Ten or Twelve Dollars, also an overcoat of the cost of which is about Nine Dollars. Please enclose rules for self-measurement with parcel and oblige.

Yours, etc.,  
Jay M. Montichorkis.

## ORDER TO A GROCER.

Kokomo, Ind., May 10, 19--.  
Geo. H. Taylor, Esq.,  
Indianapolis, Ind.

Dear Sir:—Please deliver to the bearer, with bill of cost, the following:  
30 lbs. Granulated Sugar,  
10 lbs. English Breakfast Tea,  
3 lbs. Java Coffee, roasted, not ground,  
2 boxes Ivory Soap,  
6 gals. Maple Syrup,  
1 bbl. Flour, "Drifted Snow."  
Charge in acct., and oblige,  
Yours, etc.,  
S. T. WINFIELDER.

## 5. ORDER TO MUSIC DEALER.

Chicago, Cal., Nov. 1, 19--.

Mrs. Jas. McKee,  
San Francisco, Cal.  
Dear Sir:—By return mail, please send the following pieces of music money order, covering cost, is herewith enclosed.  
Falling Leaves, by E. G. Bliss . . . . \$0.40  
Early Violets, ten short pieces, by Goodrich, published by John D. Smith, each 25c. . . . . 2.50  
Bugle Song, by Hymen Lloyd . . . . \$0.40  
Your earliest attention will greatly oblige,  
Yours truly,  
Stephen Burnley.

## INQUIRY CONCERNING SHIPMENT OF APPLES.

Abingdon, Ill., Oct. 10, 19--.  
A. R. Benton, Esq.,  
Chicago, Ill.

Dear Sir:—I have a large quantity of fine apples that I would like to place in the hands of a good Commission Merchant in your city. Would you be kind enough to give my address to some good party, directing them to report present state of the market, and advise what expense attends the hauling of the fruit after arrival?  
I am, etc.,  
Martin C. Chesneal.

## SHIPMENT OF APPLES ON COMMISSION.

Fruitville, O., Oct. 13, 19--.  
Messrs. Sumner & Co.,  
Cincinnati, O.

Gentlemen:—Your favor of the 8th inst. received. I have today shipped to your commission Three Hundred Barrels of Apples, (Rhode Island Greens), by the C.C. & L.R.R. due in your city, at their depot, on the 15th inst. Please take them in charge and sell to the best advantage, holding proceeds subject to my order.

Advise me upon receipt of fruit.  
I am yours, etc.,  
Charles Teele.

## 6. REQUEST FOR PRICE LIST.

Rome, Ga., Jan. 10, 19--.  
Messrs. Walton & Whisler,  
Atlanta, Ga.

Gentlemen:—I have recently leased a store in this place, which I am at present fitting up and stocking with a fine selection of Fancy Groceries. Please oblige me with your price list and best terms.

I am respectfully yours,  
JOSEPH ARNOLD.

Atlanta, Ga., Jan. 12, 19--.

JOSEPH ARNOLD, Esq.,  
Rome, Ga.

Dear Sir:—Yours of the 10th inst. received. We enclose price list with terms marked against the several items. We believe you can make a satisfactory selection from our stock, and would like for you to examine it if you can find it convenient to do so. If not, we shall endeavor to fill any order with which you may favor us, agreeable with instructions. We shall require Bank Draft on N.Y., for the amount of the order, or good reference.

We are respectfully,  
Walton & Whisler.

## INQUIRY AS TO RESPONSIBILITY.

Des Moines, Ia., Jan. 1, 19--.  
Mr. Geo. R. Houser,  
Crittson, Ia.

Dear Sir:—You will oblige me by stating that if Mr. Henry Roads, of the firm of W. C. Hering & Co., of your city, is known to you, and deserving of credit.  
Yours very truly,  
Seymour Bros.

# BUSINESS LETTERS CONTINUED.

## PROPOSING TO OPEN A BUSINESS ACCOUNT.

11. Grand Forks, N.D., Feb. 1, 19—  
Messrs. MERRILL, SMITH & Co.,  
St. Paul, Minn.  
Gentlemen:—Having established a business here which is rapidly increasing, we are desirous of opening an account with your house. We should be happy to receive from you a list of your goods, with your terms to the trade, and enclose our own terms for settlement.  
Should you feel willing to make an arrangement with us, Mr. Chas. Munger, of your city, will give you any information desired with regard to the condition of our affairs. Hoping to hear from you soon, we are,  
Respectfully,  
JONES & CARLETON.

## 12. REPLY TO FOREGOING.

St. Paul, Minn., Feb. 4, 19—  
Messrs. JONES & Carleton,  
Grand Forks, N.D.  
Gentlemen:—Your favor of the 1st inst. received. We should be pleased to open an account with you upon your usual terms of settlement, and enclose you the desired list with terms for the trade.  
Any order filled which you may favor us will be promptly filled, and we feel quite confident, to your satisfaction.  
We are, gentlemen,  
Very truly yours,  
MERRILL, SMITH & Co.

## 13. OPENING ANNOUNCEMENT.

TO OUR PATRONS AND FRIENDS:  
We cordially and specially invite the attention of our patrons and friends to our new display of (wee shaw wee new specialities). We have met with such liberal encouragement during the past season, and our efforts to meet the public demand have received such generous support, we feel doubly assured our present stock will prove equally inviting, and fully as desirable an exhibit as any we have heretofore made.  
(Signature).  
(Address).

## 14. REQUESTING SETTLEMENT OF ACCOUNT.

Augusta, Me., Dec. 15, 19—  
BENJAMIN SMITH, Esq.,  
Concord, N.H.  
Dear Sir:—We have, for several days past, been looking for a remittance from you, covering your May account, and as the necessity of meeting our own engagements punctually is ever before us, we are obliged to remind you that prompt payments are requisite and indispensable to the credit system.  
We are yours, etc.,  
ALDEN & MORTON.

## 15. REPLY TO ABOVE.

Concord, N.H., Dec. 17, 19—  
Messrs. ALDEN & Morton,  
Augusta, Me.  
Gentlemen:—We regret extremely our delay in meeting promptly the payment of May bills, and can only excuse ourselves on the ground of business depression and subsequent difficulty in making collections. I herewith enclose, in part payment of account named, bank draft on N.Y.

for Two Hundred Dollars (\$200), which please place to our credit. The balance shall try to remit by the 31st inst.

We remain yours, etc.,  
HERALD & LANGTRY.

## 16. FORWARDING GOODS.

San Francisco, Cal., April 6, 19—  
Messrs. PERKINS, JONES & Co.,  
Tacoma, Wash.  
Gentlemen:—According to your order of the 3rd inst. we have shipped you this day, per Steamer State of Oregon,  
200 bbls. Flour (Drifted Snow).  
15 bbls. Sweet Potatoes,  
12 bbls. Apples, (All marked P.J. & C.)  
Trusting that these will prove as satisfactory as those heretofore sent, and bring as good a price, we are,  
Yours respectfully,  
GREENE, TOBIN & Co.

## 17. PROVISION AND GROCERIES.

St. Louis, Mo., June 19, 19—  
Messrs. MILLER & VANBUSKIRK,  
Springfield, Ill.  
Gentlemen:—We take pleasure in enclosing you today's market quotations. You will notice the sharp advance in provisions and other lines. The prospects are that pork will touch \$22 before 26th inst.; other pork products are advancing in same proportion, dried fruits and canned goods are also rapidly advancing, and we look for very material advances before long; sugars, syrups, coffees, and teas are a shade lower.  
We would advise you to order provisions, dried fruits, and canned goods now, if you want any, as we think it a very favorable time to purchase. Our Mr. Newkirk will call on you the latter part of this week, and we will be pleased to have you favor him with an order.  
We remain,  
Yours truly,  
LITTLE & Webb.

## 18. COMPLANNING OF AN ERROR IN A BILL.

Galveston, Tex., July 7, 19—  
Messrs. FINNEY, COBURN & Co.,  
New Orleans, La.  
Dear Sirs:—Upon examining the bill accompanying your last lot of goods, I find I am charged with six dozen pairs of cotton hose which I neither ordered nor received. I enclose the bill and a copy of the invoice of goods, that the error may be corrected. I am, gentlemen,  
Yours very respectfully,  
IRA DUNN.

## 19. URGING PAYMENT OF RENT.

Montgomery, Ala., Aug. 4, 19—  
MR. ST. FERGUSON,  
Dear Sir:  
I have waited patiently for your convenience in the payment of rent for the house you are at present occupying. As, however, you have been my tenant for three months without making any of the payments, which were to be made monthly, feel obliged to remind you of the fact that there are \$75 due me.  
Trusting that you will give the matter immediate attention, I am,  
Yours truly,  
AMBROSE COOKE.

## 20. AN OFFICIAL LETTER.

Creeley, Col., Nov. 10, 19—  
A.B. CUDE, Esq.,  
Agent American Book Co., N.Y.  
Dear Sir:—At the last meeting of the Board of Education of this city, "Harvey's English Grammar,"

was adopted for use in our Public Schools. "Eclectic History of the U.S.," adopted a year ago, is giving the best of satisfaction.

Yours respectfully,  
BYRON SINCLAIR,  
Chairman Text Bk. Committee.

## 21. ACCOUNT SALES.

New York, Oct. 15, 19—  
Sold by, MARSH, WELSH & Co., Not Account.  
CHAS. FOX, Jeffersonville, Ind.

100 bbls. Apples, @ \$2.75.....	\$275.00
PAID	
Freight N.Y.C.R.R.....	7500
Drayage and labor.....	18.00
Commission, 5 per cent.....	13.75
	106.75
Net proceeds to your credit	\$168.25

## 22. ANSWER TO ABOVE.

Jeffersonville, Ind., Oct. 25, 19—  
Messrs. MARSH, WELSH & Co.,  
New York.  
Gentlemen:—Yours of the 15th inst. with account sales 100 bbls. apples received. The sales were satisfactory, and I am glad were so promptly rendered, as it enables me to prepare another shipment, and, I trust, secure the favorable market you report. I shall try to have them in readiness for shipment next Wednesday, 30th inst. I will make drafts against proceeds, but will notify you hereafter.  
I am, gentlemen, yours, etc.,  
CHAS. FOX.

## 23. INFORMATION AS TO BUSINESS LOCATION.

Atlanta, Ind., May 14, 19—  
R.S. WEBSTER,  
Boise City, Idaho.  
Dear Sir:—Entertaining an idea of immigrating to Idaho City, and there conducting a business similar to your own, I take the liberty of an old friend in asking your opinion on that location for the trade, and shall gratefully acknowledge any information you can give me as to the business being done in that section at the present time.  
Will you also oblige me with your views as to the expediency of a further consideration of this subject.  
I am sincerely yours,  
CLINTON PORTER.

## SUBSCRIPTION FOR PERIODICAL.

Phoenix, Ariz., Nov. 29, 19—  
MR. SHELLY TIENEN,  
496 Broadway, N.Y.  
Dear Sir:—Please find enclosed money order for One Dollar (\$1.00) for which send to my address The New Era for 19—.  
Yours, etc.,  
CONRAD SCHOFIELD.

## 25. RECOMMENDING SUCCESSORS ON RETIRING FROM BUSINESS.

Jacksonville, Fla., May 10, 19—  
Messrs. FAIRCHILD, GOOD & Co.,  
Cincinnati, O.  
Gentlemen:—It is with some feeling of regret that we announce to our friends the relinquishment of our interest in this business with the expiration of next month: Our stock and premises will at that time (June 27th) be transferred to Messrs. Pope & Co., whom we cheerfully present to your notice, and feel it our duty to recommend them for a continuance of your confidence. The members of this firm,  
Yours truly,  
ROVEN, DEAN & Co.



# AMERICAN WARS AND BATTLES.

## WARS.

War of the Revolution. . . . .	1775 to 1782
Indian War in Ohio Territory. . . . .	1780
War with the Barbary States. . . . .	1803 to 1811
Tecumseh Indian War. . . . .	1811
War with Great Britain. . . . .	1812 to 1815
Algerine War. . . . .	1815
First Seminole War. . . . .	1817
Black Hawk War. . . . .	1832
Second Seminole War. . . . .	1845
Mexican War. . . . .	1846 to 1848
Mormon War. . . . .	1856
Civil War. . . . .	1861 to 1865

Dutch War. . . . .	673
King Philip's War. . . . .	675
King William's War. . . . .	688
Deerfield, Mass. burned by Indians. . . . .	704
Haverhill, Mass. burned by Indians. . . . .	705
Tuscaroras expelled from North Carolina. . . . .	713
Queen Anne's War. . . . .	749
French and Indian War. . . . .	754 to 763
Pontiac's Conspiracy. . . . .	763
Massacre of Wyoming. . . . .	778
Treaty with the Six Nations. . . . .	784
Treaty with the Delawares. . . . .	804
War with the Creeks. . . . .	1813 to 1814
War with the Seminoles. . . . .	1835 to 1842
Cherokee Removal. . . . .	1836 to 1837
Capture of Osceola. . . . .	1837
Artoostook Disturbance. . . . .	1838 to 1839
Rogue River Indian War. . . . .	1853
Oregon Indian War. . . . .	1856
Minnesota Indian War. . . . .	1862
Chimington's Massacre, near Ft. Lyon. . . . .	1864
Moodie Disturbance. . . . .	1873
Guster Defeat by Indians. . . . .	1876
Indian Messiah Craze Disturbance. . . . .	1890

## BATTLES.

### REVOLUTION.

WHERE FOUGHT.	WHEN FOUGHT.	COMMANDERS. AMER. BRIT.	SUCCESS. ARMY.
Lexington. . . . .	Apr. 19, '75	Parker	Amer.
Ticonderoga. . . . .	May 10, '75	Allen	Amer.
Bunker Hill. . . . .	June 17, '75	Prescott	Brit.
Quebec. . . . .	Dec. 31, '75	Montgomery	Clinton
Norfolk, Va. . . . .	Dec. 19, '75	Woodford	Dummore
Boston. . . . .	Mar. 17, '76	Washington	Amer.
Ft. Mifflin. . . . .	Sept. 26, '76	Clinton	Brit.
Long Island. . . . .	Sept. 26, '76	Clinton	Brit.
Harlem Plains. . . . .	Sept. 16, '76	Washington	Brit.
White Plains. . . . .	Oct. 28, '76	Washington	Brit.
Ft. Washington. . . . .	Nov. 16, '76	Magaw	Howe
Trenton, N.J. . . . .	Dec. 26, '76	Washington	Rahl
Princeton. . . . .	Jan. 3, '77	Washington	Mawhood

WHERE FOUGHT.	WHEN FOUGHT.	COMMANDERS. AMER. BRIT.	SUCCESS. ARMY.
Hubbardston. . . . .	July 7, '77	Warner	Frazier
Ft. Schuyler. . . . .	Aug. 6, '77	Herkimer	Leger
Bermingham. . . . .	Aug. 13, '77	Stark	Baum
Brandywine, Pa. . . . .	Sept. 11, '77	Gates	Howe
Red Bank, Pa. . . . .	Oct. 19, '77	Gates	Baron
Germanstown. . . . .	Oct. 2, '77	Washington	Clinton
Stillwater, N.Y. . . . .	" 7, '77	Gates	Baron
Ft. Mifflin, Pa. . . . .	" 22, '77	Greene	Dunop
Red Bank, N.J. . . . .	" 22, '77	Greene	Howe
Monmouth. . . . .	June 28, '78	Washington	Clinton
Schoharie, N.Y. . . . .	July 2, '78	Brown	Indians
Wyoming, Pa. . . . .	" 3, '78	Butler	Butler
Quaker Hill, N.J. . . . .	Aug. 29, '78	Sullivan	Pigot
Savannah, Ga. . . . .	Dec. 29, '78	Howe	Campbell
Sunbury, Ga. . . . .	Jan. 9, '79	Lane	Prevozt
Cherry Valley. . . . .	Nov. 28, '78	Ashe	Prevozt

Kett Creek, Ga. . . . .	Feb. 14, '79	Pickens	Boud
Stony Creek, Ga. . . . .	Feb. 20, '79	Lincoln	McLean
Stony Point, N.Y. . . . .	July 16, '79	Washington	Clinton
Princeton, N.J. . . . .	Aug. 13, '79	Lee	Howe
Faulkner, N.J. . . . .	" 19, '79	Sullivan	Brant
Chemung, N.Y. . . . .	" 29, '79	Lincoln	Prevozt
Savannah, Ga. . . . .	Oct. 9, '79	Lincoln	Clinton
Charleston, S.C. . . . .	May 12, '80	Lincoln	Clinton
Waxhaw, S.C. . . . .	" 29, '80	Greene	Knyphausen
Springfield, N.J. . . . .	July 23, '80	Greene	Turnbull
Rocky Mount. . . . .	July 30, '80	Sumter	Brown
Hampton, S.C. . . . .	Aug. 7, '80	Gates	Cornwallis
Sander's Creek, S.C. . . . .	" 15, '80	Sumter	Tarleton
Fishing Creek. . . . .	" 18, '80	Sumter	Tarleton
King's Mount, S.C. . . . .	Oct. 7, '80	Campbell	Ferguson
Fishdam Ford, S.C. . . . .	Nov. 12, '80	Sumter	Wemyss
Blackstock's, S.C. . . . .	" 20, '80	Sumter	Tarleton
Cowpens, S.C. . . . .	Jan. 17, '81	Morgan	Lee
Battle of the Haw. . . . .	Feb. 25, '81	Greene	Cornwallis
Chimington's Massacre, near Ft. Lyon. . . . .	Mar. 15, '81	Greene	Rawdon
Hobbs's Hill, Va. . . . .	Apr. 25, '81	Greene	Cruizer
Ninety-Six, N.C. . . . .	May 16, '81	Eggleston	Brown
Augusta, Ga. . . . .	July 14, '81	Ledyard	Arnold
Ft. Griswold, Conn. . . . .	Sep. 6, '81	Greene	Stewart
Eutaw Springs, S.C. . . . .	Oct. 8, '81	Washington	Cornwallis
Yorktown, Va. . . . .	Oct. 15, '81	Washington	Cornwallis

### WAR OF 1812.

#### ON THE LAND.

WHERE FOUGHT.	WHEN FOUGHT.	COMMANDERS. AMER. BRIT.	SUCCESS. ARMY.
Brownstown, Can. . . . .	Aug. 5, '12	Van Horn	Tecumseh
Maquaga. . . . .	" 8, '12	Miller	Tecumseh
Detroit. . . . .	" 15, '12	Hull	Brook
Queenstown. . . . .	" 19, '12	Van Rensselaer	Brook
Odensburg. . . . .	" 21, '12	Forsyth	Brook
Ft. Chippewa. . . . .	Jan. 22, '13	Winchester	Proctor
York (Toronto). . . . .	Apr. 27, '13	Pike	Sheaffe
Ft. Meigs. . . . .	May 5, '13	Day	Proctor
Ft. Mifflin. . . . .	" 22, '13	Beasley	Winchester
Ft. George. . . . .	" 27, '13	Beasley	Winchester
Sacket's Harbor. . . . .	" 29, '13	Brown	Prevozt
Stony Creek. . . . .	June 8, '13	Winchester	Proctor
Ft. Stephenson. . . . .	Aug. 2, '13	Croghan	Proctor
Thames, Can. . . . .	Oct. 5, '13	Harrison	Proctor

WHERE FOUGHT.	WHEN FOUGHT.	COMMANDERS. AMER. BRIT.	SUCCESS. ARMY.
Chrysler's Field. . . . .	Nov. 11, '13	Boud	Morrison
La Caille Mill. . . . .	Nov. 20, '13	Wilkinson	Hancock
Washington. . . . .	Dec. 23, '13	Williston	Ross
Chippewa. . . . .	July 5, '14	Williston	Ross
Lundy Lane. . . . .	" 25, '14	Brown	Drummond
Ft. Erie. . . . .	Aug. 15, '14	Gaines	Drummond
Bladensburg. . . . .	" 24, '14	Winder	Ross
Plattsburg. . . . .	Sep. 11, '14	Macomb	Prevost
North Point. . . . .	" 12, '14	Stricker	Brooke
Ft. McIntenry. . . . .	" 13, '14	Armistead	Cochrane
Ft. Bowyer. . . . .	" 15, '14	Lawrence	Nicholls
Ft. Niagara. . . . .	" 17, '14	Brown	Drummond
9 miles from N.O. . . . .	Dec. 19, '14	Leonard	Indians
New Orleans. . . . .	Jan. 23, '15	Jackson	Keatie
		Jackson	Pakenham

#### ON THE WATER.

WHERE FOUGHT.	WHEN FOUGHT.	COMMANDERS. AMER. BRIT.	SUCCESS. VESSELS.
Off Newfoundland. . . . .	Aug. 13, '12	Porter	Laurens
Off Massachusetts. . . . .	Aug. 19, '13	Hull	Stonewall
Off North Carolina. . . . .	Oct. 18, '13	Jones	Whimpey
Near Canary Islands. . . . .	Oct. 25, '13	Sloop Wasp	Carden
Off San Salvador. . . . .	Dec. 29, '13	Bainbridge	Lambert
Off Demerara. . . . .	Feb. 24, '13	Lawrence	Pease
Massachusetts Bay. . . . .	June 1, '15	Lawrence	Broke
British Channel. . . . .	Aug. 14, '15	Allen	Maples
Off Maine. . . . .	Sep. 5, '15	Buttows	Bythe
Lake Erie. . . . .	Sep. 10, '14	Petty	Barclay
Lake Ontario. . . . .	Oct. 5, '14	Champer	Capitane
Harbor of Malapais. . . . .	Nov. 28, '14	Forney	Hilliar
Off Florida. . . . .	Apr. 29, '15	Warrington	Wales
British Channel. . . . .	Je. 28, '15	Sloop Hawk	Brigadier
Near Africa. . . . .	Sep. 1, '15	Blakely	Manning
Lake Champlain. . . . .	Sep. 11, '15	McDonough	Downie
Mobile Bay. . . . .	Sep. 15, '15	Lawrence	Shove
Lake Borgue. . . . .	Dec. 9, '15	Jones	Lockyer
Off New Jersey. . . . .	Jan. 15, '16	Decatur	Hayes
Off Madeira Island. . . . .	Feb. 20, '16	Stewart	Squadron
Off Brazil. . . . .	Mar. 23, '16	Biddle	Dickenson

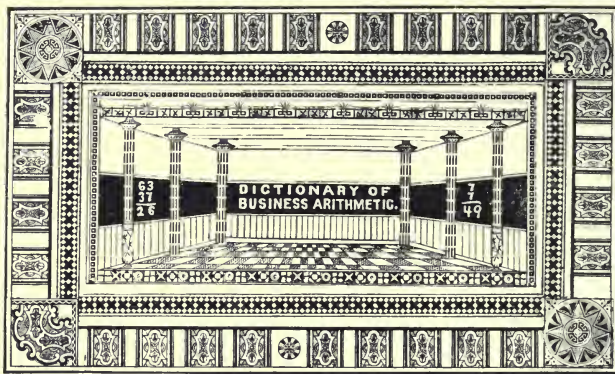
The War of 1812 was really a continuation of the War of the Revolution, caused by the impressment of American seamen, and harassing of American commerce. It is noted for the large number of naval engagements.





# NOTE.

In the following pages will be found all definitions, rules, processes, and illustrations in practical arithmetic that an ordinary business man has occasion to use.



# NOTE.

The alphabetic arrangement will be found to greatly expedite the readiness of reference, and the example following most of the rules, sufficiently elucidates their application.

**ABSTRACT.**—Separate or distinct from something else. An abstract quantity is one which does not involve the idea of matter, but simply that of a mental conception. All numbers are abstract when the unit is abstract.

**ACRE.**—A unit employed in the measurement of land. It contains 43,560 square feet, 840 square yards, or 160 square rods. In the form of a square, one side measures 208.7 feet, or 69.57 yards. (See Land or Square Measure—Index).

**ACCURATE INTEREST.**—Interest computed according to the exact number of days. To find accurate interest, compute it at the rate of 360 days to the year, and subtract from it  $\frac{1}{3}$  part of itself; in leap-year subtract  $\frac{1}{4}$ .

**ACUTE.**—Sharp as opposed to obtuse. An acute angle is one that is less than a right angle, or 90°. An acute-angled triangle is one having all of its angles acute.

**ADDITION.**—Finding the simplest equivalent expression for the aggregate of two or more quantities of the same kind. To prove the accuracy of the operation of addition, (1) Add the columns of units from the top downwards, and then from the bottom upwards; (2) Separate the numbers into two or more groups, adding each group separately, and then the several results; (3) Cast out the 9's, by taking the sum of the digits in each number to be added, and having divided each sum by 9, set down the remainder in a column at the right. Take the sum of these remainders and divide it by 9, setting the remainder beneath. If this remainder is the same as that found by dividing

the sum of the digits in the sum total by 9, the work is correct.

**ADJACENT.**—Contiguous to, or bordering upon. Adjacent angles  $c$  and  $d$  are those which have one side in common, and their other sides a prolongation of the same straight line; thus, the angles  $DBC$  and  $DBA$  are adjacent.

**AGGREGATE.**—The sum of several particulars, or an assemblage of parts to form a whole.

**ALIOQUOT PART.**—For definition see under Business Terms. To find the aliquot parts of a number, divide it by the least number except 1, that will exactly divide it; then divide the quotient by its least divisor except 1; and so on, always dividing the last quotient by its least divisor except 1, till 1 is obtained as a quotient, which, with the several divisors, constitute the aliquot parts of the number.

**ALLIGATION.**—The compounding or mixing of ingredients. (See Business Terms—Index). **Alligation Medial** is the process of finding the average value or quality of a mixture, the quality and quantity of whose ingredients are known. Thus mixing together 50

crs. bushels of oats, at 40 cents per bushel; 30 bushels of barley, at 50 cents per bushel, and 25 bushels of corn, at 60 cents per bushel, one bushel of the mixture is worth 47  $\frac{1}{3}$  cents.

**Alligation Alternate** is the process of finding what amount of each of several simple ingredients, whose prices or qualities are known, must be taken to form a mixture of any required price or quality. In solving

problems of this class, compute the balance of gain or loss on the definite quantities taken; then cancel this balance by taking a sufficient quantity of one or more of the same or other elements furnished. Example.

To make a grade worth 12¢ per pound, how many pounds at 9¢ must be mixed with 100 pounds of coffee at 12¢, and 90 pounds at 10¢? **Operation.**

Av. at	E's or loss per lb.	Lbs.	Total gain or loss.	Total value.
12	1	100	100	12.00
11	10	90	90	9.00
9	2	5	10	.45

Proof.—If 195 lb. are worth 21.45 lb. is worth ..... 11

Note.—+ shows gain, and —, loss.

**ALTITUDE.**—The height of a body, or its third dimension. To measure an accessible altitude.

Select any convenient point A, on a horizontal line through C; measure the distance CA; then measure off a distance AB towards the object, and at B set up a vertical stake; from A, sight to the top of the object, and note the point E where this line of sight cuts the stake, and then measure DB. From similar triangles ABF is to DB as AC is to EC; whence,  $EC = \frac{DB \times AC}{AB}$

Similarly the altitude of an object which is accessible, may be determined by means of its shadow.

**ANALYSIS.**—Logically deducing from the terms of a problem the conditions and relations required in its solution, which are not fully stated. Example.—If 4 lbs.

of sugar cost 28 cts., what will 9 lbs.? **Analysis.**—If 4 lbs. cost 28 cts., one pound will cost one-fourth of 28 = 7 cts., and 9 pounds will cost nine times 7 cts. = 63 cts.

**ANGLE.**—The portion of space lying between two lines, or between two or more surfaces, meeting in a common point.

**ANNUITY.**—For definition see under Business Forms and Terms. A certain annuity is an annuity payable for a definite length of time. A contingent annuity is one payable for an uncertain period of time, as during life. A deferred annuity is one not to be entered upon until after a certain period of time. A reversionary annuity is one not to be entered upon till after the death of a certain person. An annuity in possession is one to be entered upon at once. A life annuity is one to continue during the life of one or more persons. A contingent life annuity is one to continue for a certain number of years, provided a certain person survives the period mentioned. A perpetual annuity is one to continue forever. A forborne annuity is one in arrears, that is, the payment may not have been made when due. (See Compound Interest Tables, Nos. 3 and 4, also Life Annuity).

**ANTECEDENT.**—The first of the two terms in a ratio, which are compared together. It forms the standard of comparison, and must be known before the value of the other term (the consequent) can be expressed. (See Ratio).

**APPLES, Potatoes, etc.**—To find the number of bushels of apples, potatoes, etc., in a bin, Multiply the length, breadth and thickness together, and this product by 8, and point off one figure in the product for decimal.

**APOTHECARIES' Weight and Measure.**—Used in mixing and compounding medicines. For the table, see under Weights and Measures.

**ARABIC Notation.**—That method of expressing numbers by the use of characters called figures. They are, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0; the last is used for vacant orders.

**ARC.**—A part of the circumference of a circle or other curve. To find the length of an arc, use the following formula: The number of degrees (deg.) contained in an arc, and the diameter (diam.) of the circle being given, required the length (l) of the arc:

$\text{deg. diam.} \times 3.1416 \div 360 = l$

**AREA.**—The superficial contents of any surface expressed in terms of some given surface assumed as a unit or standard of comparison; the unit of measurement usually being a square.

**ARITHMETIC.**—That branch of mathematics treating of the relations and properties of numbers when expressed by the aid of figures, or combinations of figures.

**AVERAGE.**—The quotient arising from dividing the sum of two or more terms by their number; thus the average of 3, 8, 9, 11, and 14 =  $(3 + 8 + 9 + 11 + 14) \div 5 = 9$ .

For the commercial signification of this term, see under Business Forms and Terms.

**AVERAGE or Equation of Payments.**—The method of finding the time when the payment of several sums, due at different times, may be made at once, without loss of interest to either debtor or creditor. The Focal Date is the date from which the time is reckoned to the dates when the several amounts become due. (See Business Time Tables). To find the average time when all the terms of credit begin at the same time, Multiply each amount by

its term of credit, and divide the sum of the several products by the sum of the debts; the quotient will be the average term of credit.

**Example.**—A merchant purchases goods, January 6th, amounting to \$800; \$300 payable in 6 months, \$300 in 8 months, and \$300 in 10 months. When may the whole be paid without loss to either party?

**Solution.**  
\$300 for 6 mos. = \$1800 for 1 mon.  
300 " 8 " = 2400 " "  
300 " 10 " = 3000 " "  
900 ) 7200 = 8 months.

To find the average time when the terms of the credits begin at different times, Find the date when each debt becomes due. (See Business Time Tables). Find the time intervening between the earliest of these dates and the date of each succeeding amount. Multiply each amount by the time intervening between the earliest date and the date when the amount becomes due. Divide the sum of the products by the sum of the debts; the quotient will be the average

time required. Add this average time to the focal date for the day of payment. **Example.**—Required the time when the amount of the debts as below stated become due per average.

**Table:**

Date of purchase.	Amount.	Time of credit.	When due.
Jan. 6,	\$300	6 mos.	July 6.
Apr. 10,	200	6 "	Oct. 10.
May 7,	400	3 "	Aug. 7.

**Statement.**

Due.	Due Am't.	Product
From July 6 to July 6,	0 x 300	00000
" " " Aug. 7, 32 x 400		12800
" " " Oct. 10, 95 x 200		19200
	900	32000

**Ans.** 36 days from July 6th is Aug. 11th.

**AVOIRDUPOIS.**—The system of weights by which the coarser commodities are weighed, such as hay, grain, wool, and the coarser metals. For table see under Weights and Measures.

**BARREL.**—A unit of liquid measure, differing in value for different articles measured. The English wine barrel contains 31½ gallons, and the beer barrel, 36 gallons. (See Weights and Measures).

**BASE.**—The side of a plane figure upon which it is supposed to lie. In a triangle, the base lies opposite the angular point chosen as the vertex. The Base of a System of Numbers, is the value of the unit of the first order, it being the abstract number 1, for all systems of abstract numbers. In denominate numbers, the base is 1 thing of the kind numbered.

**BILLION.**—In the decimal system, a unit of the tenth order, which is a thousand millions.

**BLAZE.**—A spot made on the side of a tree, by removing the bark with an axe. It is used in surveying, and for distinguishing different points.

**BOARD MEASURE.**—The unit of lumber measure is a foot 12 inches long, 12 inches wide, and 1 inch thick. All kinds of lumber and timber are estimated by this unit, except that timber is sometimes estimated by the cubic foot. To find the contents of an inch board, Find the product of the length and breadth in feet. For a two-inch board, multiply the area by 2; for a half-inch board, divide by 2, etc. If the board tapers, take half the sum of the two ends for the average width. To find the contents of a plank, joist, etc., estimated in board measure, Find the product of the width in inches, the thickness in inches, and the length in feet; and take 1/2 of this.

If the timber tapers in width and in thickness, the contents in cubic feet may be found by multiplying half the sum of the

widths by half the sum of the thicknesses, and multiplying the result by the length in feet, and dividing by 4.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

time required. Add this average time to the focal date for the day of payment. **Example.**—Required the time when the amount of the debts as below stated become due per average.

**Table:**

Date of purchase.	Amount.	Time of credit.	When due.
Jan. 6,	\$300	6 mos.	July 6.
Apr. 10,	200	6 "	Oct. 10.
May 7,	400	3 "	Aug. 7.

**Statement.**

Due.	Due Am't.	Product
From July 6 to July 6,	0 x 300	00000
" " " Aug. 7, 32 x 400		12800
" " " Oct. 10, 95 x 200		19200
	900	32000

**Ans.** 36 days from July 6th is Aug. 11th.

**AVOIRDUPOIS.**—The system of weights by which the coarser commodities are weighed, such as hay, grain, wool, and the coarser metals. For table see under Weights and Measures.

**BARREL.**—A unit of liquid measure, differing in value for different articles measured. The English wine barrel contains 31½ gallons, and the beer barrel, 36 gallons. (See Weights and Measures).

**BASE.**—The side of a plane figure upon which it is supposed to lie. In a triangle, the base lies opposite the angular point chosen as the vertex. The Base of a System of Numbers, is the value of the unit of the first order, it being the abstract number 1, for all systems of abstract numbers. In denominate numbers, the base is 1 thing of the kind numbered.

**BILLION.**—In the decimal system, a unit of the tenth order, which is a thousand millions.

**BLAZE.**—A spot made on the side of a tree, by removing the bark with an axe. It is used in surveying, and for distinguishing different points.

**BOARD MEASURE.**—The unit of lumber measure is a foot 12 inches long, 12 inches wide, and 1 inch thick. All kinds of lumber and timber are estimated by this unit, except that timber is sometimes estimated by the cubic foot. To find the contents of an inch board, Find the product of the length and breadth in feet. For a two-inch board, multiply the area by 2; for a half-inch board, divide by 2, etc. If the board tapers, take half the sum of the two ends for the average width. To find the contents of a plank, joist, etc., estimated in board measure, Find the product of the width in inches, the thickness in inches, and the length in feet; and take 1/2 of this.

If the timber tapers in width and in thickness, the contents in cubic feet may be found by multiplying half the sum of the

widths by half the sum of the thicknesses, and multiplying the result by the length in feet, and dividing by 4.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.

**BOARDS.**—Planks of lumber, usually 12 inches long, 12 inches wide, and 1 inch thick. They are used in building, and for estimating the contents of lumber.





areas of the two ends in inches by the length in feet and dividing the product by 144. **To find** the number of cubic feet in round timber, **Find** the average circumference by adding the circumference of the larger and smaller ends and dividing by 2; multiply the square of one-fourth of this average circumference by the length in feet; the result gives four-fifths of the real contents in cubic feet, one-fifth being customarily allowed to the purchaser for waste in sawing. (See Instantaneous Method of Measuring Lumber).

**BUSHEL.**—See under Business Forms and Terms, also under Weights and Measures.

**BUTT.**—A measure for liquids, containing 108 imperial gallons.

**CANCELLATION.**—The operation of striking out the common factors in both dividend and divisor, before performing the operation of division.

**CARAT.**—A weight of four grains employed in weighing diamonds. The term is also used in measuring the fineness of gold, the whole mass being divided into 24 equal parts, the number of these parts which are pure gold will express the number of carats of fineness, as 22 carats fine.

**CARDINAL Points.**—The four principal points of the compass: North, South, East, West.

**CASK.**—**To find** the mean diameter of a cask (nearly), **Add** to the head diameter  $\frac{2}{3}$ , or, if the staves are but little curved,  $\frac{1}{6}$ , of the difference between the head and bung diameters. **To find** the contents of a cask in gallons, **Multiply** the square of the mean diameter by the length (both in inches), and this product by .0034.

**CAUSE and Effect.**—Anything operating to produce a result is a cause, and the result is the effect. **It is** a natural law that the effect is proportional to the cause which produces it. A cause or an effect may be either simple or compound: simple, when it involves but one element; compound, when it involves two or more elements. **Example.**—If 10 men in 5 days of 7 hours each, dig a trench 25 feet long, 8 feet wide, and 7 feet deep, in how many days of 12 hours each will 4 men dig a trench 12 feet long, 10 feet deep, and 8 feet wide?

**Statement.**

As Cause, 25 Cause, As Effect, 25 Effect.

10 : 12 :: 25 : 12  
5 : 4 :: 8 : 10  
7 : 8

**Operation.**

$x = \frac{12 \times 10 \times 8 \times 10 \times 5 \times 7}{12 \times 4 \times 25 \times 8 \times 7} = 5$  days.

**CENTIGRAMME.**—The hundredth part of a French gramme, equal

to about  $\frac{3}{10}$  of a grain.

**CENTILITRE.**—The hundredth part of the French litre, equal to about  $\frac{2}{3}$  of a cubic inch.

**CENTIMETRE.**—The hundredth part of the French metre, equal to about  $\frac{2}{3}$  of an inch.

**CENTURY.**—A period of time the length of which is 100 years.

**CHAIN.**—An instrument used in surveying, and is 66 feet in length, containing 100 links, each link being 7.92 inches long. It is usually called Gunter's chain.

**CHORD.**—A straight line joining the two extremities of an arc of a curve.

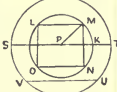
**CIPHER.**—The character 0. It signifies no number when standing by itself, but in combination, it occupies a place in the arithmetical scale, and indicates that there are no units of that order in the number.

**CIRCLE.**—A portion of a plane AEFB, bounded by a curved line, every point



of which is equally distant from a point within called the centre. The bounding line is called the circumference. The

diameter is a straight line drawn through the centre and terminated by the circumference, as AB. The radius is a straight line from the centre to the circumference, as CD. An arc is any portion of the circumference, as AE. A sector is the space included between two radii and the intercepted arc, as BCD. A chord is a straight line joining the extremities of an arc, as AD. A segment is bounded by an arc and its chord, as ADE. A plane figure is inscribed in a circle when the vertices of its angles are in the circumference of the circle, as LMNO is inscribed in the circle whose radius is PM. A circular ring is the space enclosed between the circumferences of two concentric circles. Concentric circles have the same centre but different radii, as the circles whose



radii are PK and PT. **To find** the circumference of a circle, **Multiply** the diameter by 3.1416.

**To find** the diameter of a circle, **Divide** the circumference by 3.1416. **To find** the area of a circle, **Multiply** the square of the radius by 3.1416; or **Divide** the square of half the circumference by 3.1416; or **Multiply** the circumference by one-fourth of the diameter. **To find** the diameter or circumference of a circle, **Divide** the area by 3.1416, the square root of the quotient will be half the diameter, and the diameter multiplied by 3.1416 will be the circumference. **To find** the area of a sector of a circle, **Multiply** half the length of the arc by the radius; or **Take** the same part of the area of the circle as the number of degrees in the arc are of 360°. **To find** the area of a segment, **From** the area of the sector, **subtract** the area of the triangle formed with the chord and radii, for a segment less than a semi-circle; but **add** these areas for a segment greater than a semi-circle. **To find** the area of a zone, **STUV**, **From** the area of the circle, **subtract** the areas of the segments not included in the zone.

**To find** the area of a circular ring, **Find** the difference between the areas of the two circles. **To find** the side of an inscribed equilateral triangle, **Multiply** the diameter by .866025. **To find** the side of an inscribed square, **Multiply** the diameter by .707106. **To find** the side of a square that shall contain the same area as a given circle, **Multiply** the diameter by .886227.

**CIRCULAR Measure.**—Used to determine localities, by estimating latitude and longitude; also to measure the motions of the heavenly bodies, and compute differences of time. For table, see under Weights and Measures.

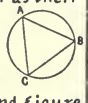
**CIRCULAR Ring.**—See Circle.

**CIRCULATING Decimal.**—One in which one or more figures are continually repeated in the same order; as, .33333, .57235723, etc. The figure or set of figures which is repeated is called the repetend.

**CIRCUMFERENCE.**—See Circle. The circumferences of different circles are to each other as their diameters, or radii.

**CIRCUMSCRIBE.**—To limit or bound. A figure drawn around another, so that all its sides or faces shall be tangent to the second figure, which is then called an inscribed figure. The circle ABC is circumscribed about the triangle ABC.

**CISTERN.**—**To find** the number of gallons in a quadrilateral cis-



tern, Multiply the length, width, and depth, in inches, together, and divide the product by 231. To find the number of gallons in a circular cistern of uniform diameter, Multiply the square of the diameter (in inches) by .7854, which product multiply by the depth (in inches); then divide by 231. To find the number of gallons in a circular cistern whose lower and upper diameters differ, To the sum of the squares of the lower and upper diameters, add the product of the lower and upper diameters; then multiply by .7854, which product multiply by the depth (all in inches); then divide by 693. (See Cisterns, under Weights and Measures).

**CLOTH Measure.**—See table under Weights and Measures.

**COIN.**—Pieces of metal, as gold, silver, copper, etc., converted into money by stamping upon them certain characters. (See Coin, under Weights and Measures).

**COMMON DIVISOR.**—Any quantity which will divide two or more other quantities without a remainder; as, 4 is a common divisor of 20, 40, and 80. The greatest common divisor of two or more numbers is the greatest number that will exactly divide each; as, 4 is the greatest common divisor of 12, 16, and 28. To find the greatest common divisor of two numbers, Divide the greater number by the less; if there be no remainder, the smaller number is the G.C.D. If there be a remainder after completing the division, divide the first divisor by this; divide this second divisor by any second remainder, and so on till an exact divisor is found. This exact divisor is the G.C.D. If there be more than two numbers, find the G.C.D. of the smallest number, and the sum of the others, which will be the greatest common divisor of all.

**COMPASS.**—An instrument to indicate the direction of the magnetic meridian, and also to determine the angle contained between that meridian and any horizontal line. It is named according to the different purposes for which it is used; as, surveyor's compass, mariner's compass, azimuth compass, etc., but the general principle is the same in all.

**COMPLEMENT.**—The difference between a number and a unit of the next higher order; thus the complement of 6 is (10-6) 4; of 76 is (100-76) 24; of 475 is (1000-475) 525; etc.

**COMPLEX Fraction.**—A fraction having a fraction or mixed number in either the numerator or

denominator, or in both; thus  $\frac{3}{5} \frac{4}{34}$ ,  $\frac{8\frac{1}{2}}{9}$ ,  $\frac{2\frac{1}{2}}{3\frac{1}{2}}$ , are complex fractions. To reduce a complex fraction to a simple fraction, Divide its numerator by its denominator.

**COMPOSITE Number.**—One that can be divided by some other number besides itself and unity; as, 10, 18, 48, 75, etc.

**COMPOUND.**—Composed of different things. **Compound Addition, Subtraction, Multiplication, and Division,** are names given to these several operations, when the numbers are expressed in a varying scale; as, years, months, days; bushels, pecks, quarts, etc.

**Compound Fraction.**—A fraction of a fraction, or several fractions connected by the word of. To reduce a compound fraction to a simple fraction, Find the product of the numerators, and write it over the product of the denominators. **Compound Inter-**

ratios of the compound ratio as in Simple Proportion. Then, if an extreme term be required, it will be equal to the quotient of the product of the means divided by the product of the known extremes, and if a mean term be required, it will be equal to the product of the extremes divided by the product of the known means. Example.—If 10 men can mow 40 acres of grass in 3 days by working 8 hours each day, how many men will it take to mow 80 acres of grass in 4 days, working 6 hours each day? Ans. 20 men.

**Statement.**

$$\begin{array}{l} 40 \text{ A. } .80 \text{ A.} \\ 4 \text{ days } : 3 \text{ days } :: 10 \text{ men : } x \text{ men.} \\ 6 \text{ hours } : 8 \text{ hours } \end{array} \quad \begin{array}{l} 80 \times 3 \times 8 \times 10 = 20. \\ 40 \times 4 \times 6 \end{array}$$

**COMPUTE.**—To reckon by the aid of figures or characters; to practically apply the rules of a science to individual examples.

**CONCAVE.**—A term applied to the inner surface of hollow bodies, and by analogy extended to lines.

**CONCENTRIC.**—A term applied to circles or spheres having the same centre but different radii, and sometimes, by analogy, to other surfaces and lines.

**CONCRETE.**—A term signifying that a quantity carries with it the idea of matter, as 10 boxes, 7 men, 5 stones, as opposed to abstract quantities, 10, 7, 5.

**CONE.**—A solid which may be generated by a right-angled triangle CAD, revolving about one of its sides, CD, adjacent to the right angle. The side CD, is called the axis, and its length measures the altitude of the cone. The side AD, generates a circle called the base, and the hypotenuse CA, generates a curved surface, which is called the lateral or convex surface of the cone. The length of the hypotenuse measures the slant height of the cone. A right cone has a circular base and a curved surface. The frustum of a cone (or pyramid) is that part that remains after cutting off the top by a plane parallel to the base. The perimeter is the circumference of the base. To find the entire surface of a cone (or regular pyramid), Multiply the perimeter of the base by half of the slant height, and to the product add the area of the base. To find the solidity of a cone (or any pyramid), Multiply the area of the base by one-third of the altitude. To find the entire surface of a frustum of a cone (or right pyramid), Multiply the sum of the perimeters, or circumferences of the two ends, by half of the slant height, and to the product add the



est. Interest on both principal and interest. To compute compound interest, Find the interest on the given principal to the time the interest becomes due, and add the principal. Then find the interest on this amount for the next period, and add as before, and so continue for each successive period to the time of settlement. Subtract the given principal from the last amount, and the remainder will be the compound interest. If there be months and days, find the amount for the years, and the interest on this for the remainder of the time. (See Compound Interest Tables). **Compound Number.**—A number constructed according to a varying scale; as, Tenz, 10 lb. Called also *denary*, *avoirdupois*.

**Compound Ratio.**—The product of two or more ratios. **Compound Proportion.**—An equality of two compound ratios, or of a compound ratio and a simple one. In solving problems in Compound Proportion, Arrange the terms of each of the simple





areas of the two ends. **To find** the solidity of the frustum of a cone (or any pyramid), Multiply together the areas of the two bases, and extract the square root of the product. This root will be the area of a base which is a mean between the other two. Take the sum of the areas of the three bases, and multiply it by one-third of the altitude; the product will be the solidity.

**CONSEQUENT.**—The second term of a ratio. If the value of a ratio is given, and the antecedent is known, the consequent may be found by multiplying the ratio by the antecedent.

**CONTENTS.**—The contents of a plane figure is the number of times which the figure contains some given area assumed as the unit of surface. It is the same as the area. The contents of a solid, is the number of times which the solid will contain some particular solid assumed, as the unit of volume. It is the same as the volume.

**CONTOUR.**—The bounding line, or perimeter, of a plane figure. The contour of ground, has reference to the surface of any part of the earth with respect to its undulations and accidents.

**CONTRACTION.**—The process of shortening any operation. For the contractions of the different operations, as Multiplication, Division, etc., see each in its proper order.

**CONVEX.**—Protuberant outwards, as the outer surface of a sphere. The opposite of concave.

**CUBE, or Hexahedron.**—A regular polyhedron bounded by six equal squares. It is the unit of measure for all volumes. The volume of any cube is equal to the product obtained by taking one of its edges three times as a factor. The cube of a number or quantity, is the product obtained by taking the number or quantity three times as a factor.

**CORN.**—Two cubic feet of good, sound, dry corn in the ear will make a bushel of shelled corn. **To find**, then, the number of bushels of shelled corn in a crib of corn in the ear, Multiply the length, breadth, and height (all in feet) together, and divide the product by 2. (See Bushel, under Weights and Measures).

**CUBE ROOT.**—A quantity which being taken three times as a factor, will produce the quantity of which it is the cube root; thus, 4 is the cube root of 64, because  $4 \times 4 \times 4 = 64$ . **To find** the cube root of a whole number, Separate the number into periods of three figures each, beginning at the right hand; (the left hand period will often contain less

than three figures). Find the greatest cube in the left-hand period, and place its root at the right, like a quotient. Subtract the cube of this root from the left-hand period, and to the remainder annex the figures of the next period, and call this number the dividend. Take three times the square of the root found considered as tens for a trial divisor. Find how many times it is contained in the dividend, and write the quotient as the next figure of the root; then multiply the divisor by this last root figure, placing the product under the dividend. Multiply the square of the last root figure by the preceding root figure or figures considered as so many tens, and this product by 3, and place the product under the last, then under these two products place the cube of the last root figure, and find their sum, calling it the subtrahend. Subtract the subtrahend from the dividend, and to



the remainder bring down the next period for a new dividend, with which proceed as before till the required root be found. If any dividend be too small to contain the trial divisor, place a cipher in the root, and then proceed as before. If there be a remainder after the last period is used, annex periods of ciphers and continue the operation until the requisite number of decimal places be obtained. Extract the cube root of both terms of a common fraction when they are perfect powers; otherwise multiply the numerator by the square of the denominator, and divide the root of the product by the denominator, the result will be the root required. To extract the cube root of decimals or mixed decimals, ciphers must be added to fill the periods; if the root does not contain sufficient decimal places, prefix ciphers. In pointing off a mixed decimal into periods, begin at the decimal point, and point off in both directions. The following table contains

the cube roots of numbers from 1 to 1,332.

No.	CUBE ROOT	No.	CUBE ROOT	No.	CUBE ROOT	No.	CUBE ROOT
1	1	59	3.924	117	4.890	175	5.593
2	1.259	60	3.912	118	4.904	176	5.604
3	1.442	61	3.936	119	4.918	177	5.614
4	1.587	62	3.957	120	4.932	178	5.625
5	1.709	63	3.979	121	4.946	179	5.635
6	1.817	64	4	122	4.959	180	5.645
7	1.912	65	4.020	123	4.973	181	5.656
8	2	66	4.041	124	4.986	182	5.667
9	2.080	67	4.061	125	5	183	5.677
10	2.154	68	4.081	126	5.013	184	5.687
11	2.223	69	4.101	127	5.026	185	5.698
12	2.289	70	4.121	128	5.039	186	5.708
13	2.351	71	4.140	129	5.052	187	5.718
14	2.412	72	4.160	130	5.065	188	5.728
15	2.468	73	4.179	131	5.078	189	5.738
16	2.519	74	4.198	132	5.091	190	5.748
17	2.571	75	4.217	133	5.104	191	5.758
18	2.620	76	4.235	134	5.117	192	5.768
19	2.668	77	4.254	135	5.129	193	5.778
20	2.714	78	4.272	136	5.142	194	5.788
21	2.758	79	4.290	137	5.155	195	5.798
22	2.802	80	4.308	138	5.167	196	5.808
23	2.843	81	4.326	139	5.180	197	5.818
24	2.884	82	4.344	140	5.192	198	5.828
25	2.924	83	4.362	141	5.204	199	5.838
26	2.962	84	4.379	142	5.217	200	5.848
27	3	85	4.398	143	5.229	201	5.857
28	3.036	86	4.414	144	5.241	202	5.867
29	3.072	87	4.431	145	5.253	203	5.877
30	3.107	88	4.447	146	5.265	204	5.886
31	3.141	89	4.464	147	5.277	205	5.896
32	3.174	90	4.481	148	5.289	206	5.905
33	3.207	91	4.497	149	5.301	207	5.915
34	3.239	92	4.514	150	5.313	208	5.924
35	3.271	93	4.530	151	5.325	209	5.934
36	3.301	94	4.546	152	5.336	210	5.943
37	3.332	95	4.562	153	5.348	211	5.953
38	3.361	96	4.578	154	5.360	212	5.962
39	3.391	97	4.594	155	5.371	213	5.972
40	3.419	98	4.610	156	5.383	214	5.981
41	3.448	99	4.626	157	5.394	215	5.990
42	3.476	100	4.641	158	5.406	216	6
43	3.503	101	4.657	159	5.417	217	6.005
44	3.530	102	4.672	160	5.428	218	6.015
45	3.556	103	4.687	161	5.440	219	6.027
46	3.583	104	4.702	162	5.451	220	6.038
47	3.608	105	4.717	163	5.462	221	6.045
48	3.634	106	4.732	164	5.473	222	6.055
49	3.659	107	4.747	165	5.484	223	6.064
50	3.684	108	4.762	166	5.495	224	6.073
51	3.708	109	4.776	167	5.506	225	6.082
52	3.732	110	4.791	168	5.517	226	6.091
53	3.756	111	4.805	169	5.528	227	6.100
54	3.779	112	4.820	170	5.539	228	6.109
55	3.802	113	4.834	171	5.550	229	6.118
56	3.825	114	4.848	172	5.561	230	6.125
57	3.848	115	4.862	173	5.572	231	6.135
58	3.870	116	4.876	174	5.582	232	6.144

**CUBIC MEASURE.**—Used for computing the contents of solid substances or volume of any space. It is also called solid measure. For table see under Weights and Measures.

**CUBIC UNITS.**—Standard measures of volume. The primary cubic units are—cubic yard, cubic foot, and cubic inch.

**CURVE.**—A line which changes its direction at every point; i.e., no three consecutive points of which lie in the same straight line.

**CYLINDER.**—A solid which may be generated by revolving a rectangle about one of its sides. This side is its axis. The opposite side generates a single curved surface, called the convex or lateral surface of the cylinder, and the two adjacent sides or ends generate circles called bases of the cylinder. The distance between the bases is called the altitude. **To find** the convex surface of a cylinder, Multiply the diameter by 3.1416, and this product by the length. **To find** the solid contents of a cylinder, Multiply the square of the diameter by .7854, and this product by the length.



**DAY.**—The natural period of time which elapses between two consecutive transits of one of the heavenly bodies over the meridian. (See Day under Business Forms and Terms).

**DECAGON.**—A polygon of ten sides and ten angles. If the sides are all equal and the angles equal, it is a regular decagon, and may be inscribed in a circle. **To find** the area of a regular decagon, Multiply the square of one of its sides by 7.6942.

**DECGRAMME.**—A French weight of ten grammes, each gramme being equivalent to about 15.438 grains Troy.

**DECALITRE.**—A French measure containing ten litres, equivalent to 61.028 cubic inches.

**DECMETRE.**—A French measure containing ten metres, or 393.71 English inches.

**DECIMAL.**—Any number expressed in the scale of tens; but a decimal fraction is generally understood. A decimal fraction is a fraction whose denominator is some power of ten; as,  $\frac{1}{10}$ ,  $\frac{1}{100}$ , &c. In writing decimals, it is common to not express the denominators, thus the above fractions would be written, .7, .07, .007. The number of places of figures which follows the decimal point indicates the number of 0's in the denominator. The decimal point is a period used to separate integers from decimals, and when no integers are expressed, the decimal point is placed at the left of tenths' order. **To write** decimals, Write the decimal as a whole number, and place the decimal point so that the right-hand figure shall be of the lowest decimal order to be expressed, prefixing ciphers if necessary. **To read** decimals, Read the figures as in whole numbers, and add the name of the lowest decimal order expressed. **To add** or subtract decimals, Write the numbers so that the decimal points shall fall in column, then proceed as in whole numbers. **To**

multiply decimals, Multiply as in whole numbers, and in the product point off as many decimal places as are in both factors. **To divide** decimals, Divide as in whole numbers, and point off in the quotient as many decimal places as the dividend has more than the divisor.

**DECIMAL Currency.**—A currency having decimal relations, as the various denominations of the money of the United States, called Federal Money.

**DEDUCE.**—To infer, or draw a conclusion from given premises. The method of reasoning is called deductive, and the conclusion is called a deduction.

**DEGREE.**—The 360th part of the circumference of a circle. A degree of longitude is the length of a portion of a meridian between two points, whose latitudes differ from each other by one degree. Owing to the spheroidal form of the earth, the length of a degree of latitude is different at different distances from the



equator. At 20° either north or south latitude, the length of a degree of latitude is 68.719 statute miles; at 25°, 68.822 miles; at 30°, 68.871; at 35°, 68.925; at 40°, 68.984; at 45°, 69.044; at 50°, 69.104. A degree of longitude is the 360th part of any circle of latitude. The length of a degree of longitude varies with the length of the circles of latitude from the equator, where it is greatest, to the poles, where it is nothing. For the length of a degree of longitude at different points, see Longitude, under Weights and Measures.

**DENARY Scale.**—A unit of measure whose ratio is ten.

**DENOMINATE Number.**—A number whose unit of measure is a concrete quantity, as 7 feet, 125 pounds, #40, &c. A simple denominator number refers to units of only one kind or value, as 15 bushels, 45 pounds, &c. A compound denominator number refers to units of different values

but of the same variety or application, as 5 lb. 6 oz., 10 hrs. 15 min. 30 sec., &c. **For** the tables relating to denominate numbers, see under Weights and Measures. The percentage of denominate numbers may be obtained by reducing them to the lowest denomination, or to the decimal of the highest, and then proceed as in simple numbers.

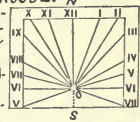
**DENOMINATOR.**—That term of a fraction which indicates the value of the fractional unit, as 8 in the fraction  $\frac{3}{8}$ , indicating that the fractional unit is  $\frac{1}{8}$ . Multiplying the denominator divides the fraction, and dividing it multiplies the fraction. The denominator of a decimal fraction is generally suppressed.

**DESCENDING Series.**—One in which each term is numerically less than the preceding one, as 8 : 4 : 2 : 1 : &c.

**DIAGONAL.**—A straight line joining the vertices of two angles of a polygon, which are not adjacent, as AC and AD in the polygon ABCDE.



**DIAL.**—An instrument for determining the hour of the day, by means of a shadow cast by the sun. In the construction of a



dial, the sun's apparent motion is supposed to be uniform throughout the day, and to take place in a circle whose plane is parallel to the equator.

**DIAMETER.**—For definition and rules for finding, see Circle. The following table gives the diameters, areas, and circumferences of circles and sides of squares whose areas coincide with those of the circles. By combining and multiplying, the area of any circle having diameter greater than 10 can also be found.

Diam.	Circum.	Area.	Side of Eq. Sq.
1.00	3.141592	0.78539	0.88622
1.25	3.926990	1.227184	1.10778
1.50	4.712388	1.767145	1.32934
1.75	5.497787	2.405281	1.55089
2.00	6.283185	3.141592	1.77245
2.25	7.068583	3.976078	1.99401
2.50	7.853981	4.908738	2.21556
2.75	8.639379	5.939573	2.43712
3.00	9.424777	7.068583	2.65868
3.25	10.210176	8.295768	2.88023
3.50	10.995574	9.621127	3.10179
3.75	11.780972	11.044661	3.32335
4.00	12.566370	12.566370	3.54490
4.25	13.351768	14.186254	3.76646
4.50	14.137166	15.904312	3.98802
4.75	14.922565	17.720546	4.20957
5.00	15.707963	19.634954	4.43113
5.25	16.493361	21.647536	4.65269
5.50	17.278759	23.759294	4.87424
5.75	18.064157	25.967228	5.09580
6.00	18.849555	28.274333	5.31738



Diam.	Circum.	Area	Side of Eq. Sq.
6.25	19.634954	30.679615	5.53891
6.50	20.420352	33.182072	5.76047
6.75	21.205750	35.784703	5.98209
7.00	21.991144	38.484560	6.20358
7.25	22.776546	41.282490	6.42514
7.50	23.561944	44.178646	6.64670
7.75	24.347343	47.172971	6.86825
8.00	25.132741	50.265483	7.08981
8.25	25.918139	53.456182	7.31137
8.50	26.703537	56.745017	7.53292
8.75	27.488935	60.132046	7.75448
9.00	28.274333	63.617251	7.97604
9.25	29.059732	67.200630	8.19759
9.50	29.845130	70.882184	8.41915
9.75	30.630528	74.661912	8.64071
10.00	31.415926	78.539818	8.86227

**DIFFERENCE.**—The result obtained from subtracting one sum from another. It is generally understood that the less quantity is to be taken from the greater, but the greater may be taken from the less, the result being a negative quantity.

**DIGITS.**—The ten characters, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, by the aid of which all numbers are expressed.

**DIMENSION.**—Extension in one direction. Every body has three dimensions, length, breadth, and height, or thickness. A line is extended in one direction, and a surface in two directions.

**DISCOUNT.**—An allowance made for the payment of money before it is due. The actual amount to be paid is called the present value, and the difference between the amount specified and the present value, is the discount. **Bank discount** is discount on the entire principal. The proceeds are the principal less the bank discount. **True discount** is discount on such a sum of money as would amount to the face of the note, if put at interest at the given rate and for the given time. The present worth is the principal amount less the true discount. **Mercantile discount** is any allowance, or per cent off. **To compute bank discount.** Multiply the amount by  $\frac{1}{100}$  the number of days, including the day of discount, and the three days of grace, and in the product point off three decimals. This will give the interest at 6%. For any other rate, add or subtract in proportion as the given rate is greater or less than 6%. **To find true discount.** Divide the amount by 1.00 plus the product of the rate and time; the quotient will be the present worth; subtract this from the amount, and the remainder will be the true discount. (See Compound Interest Tables).

**DIVIDEND.**—A quantity which is to be divided by another, called the divisor.

**DIVISION.**—The operation of finding from two quantities a third, which multiplied by the first shall produce the second. The first is

called the divisor, the second, the dividend, and the third, the quotient. Any part left undivided, is called the remainder. **To prove the accuracy of the operation.** (1) Multiply the divisor by the quotient, adding in the remainder, if any; the result should equal the dividend. (2) Add the excess of 9's in the remainder to the excess of 9's in the product of the excess in the divisor, multiplied by the excess in the quotient (without the remainder or fractional part). The excess of 9's in this sum of excesses should equal the excess of 9's in the dividend. **Contractions.**—To divide by 10, 100, 1000, etc., Cut off from the right-hand of the dividend as many figures as there are ciphers in the divisor, or re-

193)74020(383  
 519  
 181  
 154  
 680  
 519  
 101  
 Excess of 9's in rem. = 2  
 Excess in divid. = 4  
 " quot. = 5  
 " prod.(5x4) = 2  
 Sum of excesses = 4  
 Excess in divid. = 4



move the decimal point as many places toward the left as there are ciphers in the divisor. **To divide by a composite number,** as 36 (3x4), 360 (3x4x10), etc., Divide first by one of the factors, and the resulting quotient by another factor, and proceed thus till all the factors have been used. **Example.**—Divide 21073 by 96, using factors 8, 4, and 3.

**Operation.**  
 8 21073  
 4 2634 Rem. 1 = 1 unit of 1st dividend  
 3 658 Rem. 2(2x3)16 " " "  
 219 Rem. 1  
 (1x48) = 32 " " " "  
 Hence true Rem. = 49

**DIVISOR.**—That factor in division by which the dividend is to be divided. Any number is divisible by 2 or 5 if the last figure is divisible by 2 or 5; it is divisible by 4 or 25 if the last two figures are divisible by 4 or 25; it is divisible by 8 or 125 if the last three figures are divisible by 8 or 125; it is divisible by 3 or by 9 if the sum of

its figures is divisible by 3 or by 9. **DODECAGON.**—A polygon of twelve sides or twelve angles. To inscribe a regular dodecagon in a circle, apply the radius six times to the circumference as a chord; bisect the arcs subtended by the chords, and join each of the points of bisection with the vertices of the consecutive angles formed by the chords.

**DOLLAR.**—A silver coin of the United States whose value is 100 cents or 10 dimes. The original form of the sign \$ was probably a barred 8, \$, signifying 8 Reals, the divisions of the Spanish Dollar, adopted as the basis of the United States coinage. Some regard the sign as a monogram of the letters U.S.

**DRY MEASURE.**—Used for measuring articles not liquid, as salt, fruit, grain, etc. For table use under Weights and Measures.

**DUODECIMAL.**—A system of numbers whose scale is 12, the unit of each order being equal to twelve times a unit of the next lower order. The system is used by artificers in estimating the superficial and solid contents of their work. The following table gives the names of the units:  
 12 fourths (") = 1 third, marked "  
 12 thirds " " = 1 second "  
 12 seconds " " = 1 inch (prime) "  
 12 inches (primes) " = 1 foot " " "  
 12 feet " " = 1 rod " " "

Duodecimals may be added, subtracted, multiplied, or divided, like compound numbers, but are chiefly used in multiplication. **To multiply duodecimals.** Write the multiplier under the multiplicand, placing units of the same order in column. Multiply, first by the feet, next by the inches, and so on, recollecting that the product will be of that denomination denoted by the sum of their indices. Add the several partial products together, and their sum will be the required product. **Example.**—How many sq. ft. in a board 9 ft. 5 in. long, and 2 ft. 8 in. wide?

**Operation.** 5' x 2 ft. = 10 in. =  $\frac{5}{3}$  x 2;  
 9 ft. x 2 ft. = 18 sq. ft.  
 2 ft. 8' = 32'  
 18' 10' = 28' 4" =  $\frac{71}{3}$  ft.  
 3' 4" = 3' 4" = 3' 4"  
 25 sq. ft. 1' 4" = 25 sq. ft. 1' 4"

**ECCENTRIC.**—Two spheres, spheroids, circles, or ellipses, are said to be eccentric, when one lies within the other, but has not the same centre. The term is opposed to concentric.

**EDGE.**—The line in which two faces of a polyhedral angle meet each other. The edge of a polyhedron is the line in which two adjacent faces meet each other.

**ELLIPSE.**—A curved line having two centres, called foci, and two diameters, called the major

and minor axes.

The sum of the distances from any point in it to two fixed points is equal to the longest diameter, which diameter passes through those points. Thus  $EF + EG = AB$ . The points  $F$  and  $G$  are the foci; the point  $O$  is the centre of the ellipse.

To find the area of an ellipse, Multiply the product of the longer and shorter diameters by .7854.

**EQUIANGULAR.**—Having all the angles equal, as a square.

**EQUILATERAL.**—Having all the sides equal, as a square.

**EQUATION OF ACCOUNTS.**—The process of finding at what time the balance of an account can be paid without loss to either debtor or creditor. (It is also called "Averaging of Accounts" and "Compound Equation of Payments"). To find the equated time, Assume the earliest date upon which any item of the account becomes due to be the time of maturity for all of the items. Multiply each item by the number of days intervening between this assumed date and the date upon which it becomes due, and find the sum of these products on each side of the account. Then divide the difference between the sums of the debit and credit products by the balance of the account; the quotient will be the time for consideration or average term of credit. When the difference of products and the balance of the account fall on the same side count forward; when on opposite sides count backward; that is, when the balance of account and balance of interest or discount go to the same party count backward; when they go to opposite parties count forward. **Example.**

Dr.					Cr.
July 3, 1870, 200x	2	440	July 1, 1870, 200x	0	
Oct. 1, " 125x 32= 11500	Oct. 1,	150x 94= 14100			
Nov. 15, " 200x 127= 27400	Dec. 2,	300x 172= 51600			
Feb. 24, 1871, 140x 238= 33320		\$ 650	67700		
Apr. 1, " 180x 224= 32280		59200	225= 262		
\$ 875	224720		262 days from July 1,		
650	65700		1870, is March 20, 1871.		
\$ 225	59020				

**EQUATION OF PAYMENTS.**—See Average of Payments.

**EVEN NUMBER.**—Any number divisible by 2, as 4, 10, 18, etc.

**EVOLUTION.**—The process of finding one of several equal factors of a product. It is also called extracting the root of a power. It is opposed to involution. (See Cube Root and Square Root).

**EXAMPLE.**—An individual or single application of a general principle or rule, generally given to illustrate the nature of the rule or its mode of application.

**EXCHANGE.**—For definition, see

under Business Forms. To find the cost of a draft at sight, Add the premium to the face of the draft, or subtract the discount. **Example.**—How much must be paid for a draft of \$1000 on New York at a premium of  $1\frac{1}{2}\%$ ?  $1\frac{1}{2}\%$  of \$1000 = \$15 premium.

1000 face of draft.  
\$15 premium.  
\$1015 total cost.

To find the face of a draft, the cost and rate being given, Divide the cost by \$1 plus the rate of premium, or \$1 minus the rate of discount. **Example.**—A draft was purchased on Chicago for \$3226.05, at a premium of  $\frac{1}{4}\%$ , and another on Denver for \$2397.88, at a discount of  $\frac{3}{4}\%$ . What was the face of each?

$1.00 + .005 = 1.005$   $3226.05 / 1.005 = 3210$  face of draft on Chicago.  
 $1.00 - .0075 = .9925$   $2397.88 / .9925 = 2416$  face of draft on Denver.  
(See Foreign Exchange).

**EXPECTATION.**—The value of any chance which depends upon some contingent event. Thus,



if a person is to receive the sum of \$200 upon the occurrence of an event which has an equal chance of happening or failing, the expectation of the sum is worth \$100. If there are three chances of the event's failing, and only one of its happening, the expectation is worth only \$50. **Expectation of Life.**—A phrase applied to the average duration of life after any given age as determined by the tables of mortality. If it is found from a great number of recorded examples, that of all the individuals who reach the age of 30, the average remaining period of existence is 34.34 years, then is the expectation of life at that age 34.34 years. (See Carlisle Table of Mortality, under Weights and Measures).

**EXTRACTION OF ROOTS.**—The process of finding a quantity, which being taken as a factor a certain number of times, will produce a given quantity. (See Cube Root and Square Root).

**EXTREME.**—In a proportion, the first and last terms, are called extremes, the remaining two the means. When the proportion has but three different terms, the middle one is a geometrical mean, or a mean proportional between the extremes. In the proportion

3 : 9 :: 4 : 12,  
3 and 12 are the extremes, also in the proportion

3 : 6 :: 6 : 12,  
3 and 12 are extremes, and 6

is a mean proportional between them. In a geometrical progression, any term is a mean proportional between the preceding and succeeding term, and if there is an odd number of terms, the middle one is a mean proportional between the extremes. Also the product of the two extremes is equal to the product of any two means equally distant from the extremes. In an arithmetical progression, the sum of the extremes is equal to the sum of any pair of terms which are situated at equal distances from the extremes. The sum of the progression is equal to the half sum of the extremes multiplied by the number of terms.

**FACE.**—The plane surface of any solid.

**FACTOR.**—A quantity which will divide another is said to be a factor of it. To resolve a quantity into its factors, is to find two or more quantities, which when multiplied together, will produce the given quantity; thus the factors of 4 are 2, 3, and 7.

The prime factors of a quantity, are those factors which cannot be exactly divided by any other quantity except 1, which is a prime factor of every number. The process of resolving numbers into their factors is called factoring.

To resolve a number into its prime factors, Divide the given number by any prime **Operation.**  
number that will exactly divide it; divide the quotient in the same manner, and so continue to divide, until a quotient is obtained which is a prime number; the last quotient and the several divisors will constitute the prime factors of the given number. (See Divisor).

**FALLING BODIES.**—In falling from a height, a body will fall 16 feet the first second, three times that distance in the second, and so on, the space passed over in each successive second increasing as the odd numbers, 1, 3, 5, 7, 9, 11, etc. The entire space passed over is as the square of the time.

To find the height from which a body falls, Multiply the square of the time occupied in falling by 16, and the product will be the height.



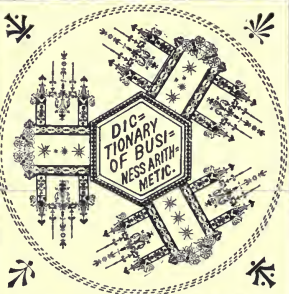
**FIGURE.**—A character employed to represent numbers. The following are the Arabic figures: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. By proper combination these are sufficient to represent every possible number. (See Notation).

**FOOT.**—A linear measure whose length is 12 inches. In other than English speaking nations, the foot varies from this.

**FOREIGN EXCHANGE.**—Bills of Exchange are generally drawn in the money of the country in which they are made payable. (See Coin, under Weights and Measures, also Bill, under Business Forms and Terms). **To find the value of sterling (English) money,** Reduce the shillings and pence, if any, to the decimal of a pound, and multiply by the given rate per pound. (See Sterling Money). **To change U.S. money to Sterling,** Divide the given amount by the value of £1 at the given rate. Reduce the remainder, or the decimals in the quotient, if any, to shillings and pence.

**FRACTION.**—One or more of the equal parts of 1. One of the equal parts is called a fractional unit; thus in the fraction  $\frac{1}{8}$ ,  $\frac{1}{8}$  is the fractional unit. **Fractions** are either common (vulgar) or decimal. For the explanation of decimal fractions, see Decimal. **Common fractions** are those in which the denominator is expressed, and may be any quantity. They are written in the form  $\frac{3}{4}$ , which denotes that the quantity  $\frac{1}{4}$  is taken 3 times. The parts 3 and 4 are called terms of the fraction, 3 being the numerator, and shows how many parts are taken; 4 is the denominator, and shows into how many parts the unit is divided. **A proper fraction** is one in which the numerator is less than the denominator, as  $\frac{3}{4}$ . **An improper fraction** is one in which the numerator is greater than the denominator, as  $\frac{5}{4}$ . **A mixed fraction** is an expression composed of two parts, one part being entire, and the other fractional, as  $4\frac{1}{2}$ . **Multiplying the numerator of a fraction, multiplies the fraction.** **Dividing the numerator of a fraction, divides the fraction.** **Multiplying the denominator of a fraction, divides the fraction.** **Dividing the denominator of a fraction, multiplies the fraction.** **Multiplying or dividing both terms of a fraction by the same number, does not alter its value.** **To reduce a fraction to its lowest terms,** Divide both terms by any common factor; divide the resulting fraction in the same manner, and so on till no number greater than 1 will exactly divide both terms. Or, Divide both terms by their greatest common divisor. **To reduce an im-**

**proper fraction to a whole or mixed number,** Divide the numerator by the denominator. **To reduce a whole or mixed number to an improper fraction,** Multiply the whole number by the denominator of the fraction; add the numerator to the product, and write the sum over the denominator. **To reduce a whole number to a fraction having a given denominator,** Multiply together the whole number and the denominator, and write the denominator beneath the product. **To reduce a compound fraction to a simple one,** see Compound Fraction. **To reduce fractions of different denominators to equivalent fractions having a common denominator,** Multiply both terms of each fraction by the product of all the denominators except its own. **To reduce fractions of different denominators to equivalent fractions having the least common denominator,** Find the least



common multiple of the denominators of the given fractions, and multiply both terms of each fraction by the quotient of the least common multiple, divided by the denominator of the fraction. **To add fractions,** Reduce them to a common denominator; then add their numerators, and place the sum over the common denominator. **To subtract fractions,** Reduce them to a common denominator, find the difference between their numerators, and place it over the common denominator. **To multiply a fraction by a fraction,** Multiply together the numerators for a new numerator, and the denominators for a new denominator. **To multiply a fraction by a whole number, or a whole number by a fraction,** Write 1 under the whole number for a denominator, and proceed as in last rule. **To divide a fraction by a fraction,** Invert the divisor; multiply the numerators together for a new numerator,

and the denominators for a new denominator. **To divide a whole number by a fraction, or a fraction by a whole number,** Write 1 under the whole number for a denominator, and proceed as in last rule. **To reduce a complex fraction to a simple fraction,** see Complex Fraction.

**FRUSTRUM.**—A piece or part of a solid separated from the rest, as the frustrum of a pyramid or cone. **To find the solidity of a frustrum,** see Cone.

**FURLONG.**—A linear unit of length equal to 660 feet or  $\frac{1}{8}$  of a mile.

**GAUGING.**—The operation of finding the contents of casks and vessels of any form. **Wage** is the difference between the actual contents of a vessel and its capacity, or that part which is empty. **To find the contents of a cylindrical vessel,** Find the contents in cubic inches (see Cylinder), and divide by 2150.42 for the measurement in bushels; by 282 for beer gallons, and by 231 for wine gallons. **To find the contents of a cask,** see Cask. **To find the contents of ullage casks, when the cask is standing,** Find one-third the sum of the head, mean, and bung diameters, and square the result; multiply by the height of the fluid in inches, and that product by .0034 for wine gallons, and by .0028 for beer gallons.

**GENERAL AVERAGE.**—For definition, see under Business Terms. **To make a claim for General Average valid, three considerations are necessary:** (1) An imminent common peril and a necessity for some sacrifice; (2) A voluntary sacrifice of a part to save the rest; (3) The success of the effort to save a part, as a result of the sacrifice made. **To find General Average,** Divide the total loss subject to average by the sum of the values of the contributory interests, and multiply each interest by the per cent. thus found.

**GEODESY.**—That branch of Surveying in which the curvature of the earth is taken into account.

**GEOMETRICAL PROGRESSION.**—See Progression.

**GEOMETRY.**—That branch of Mathematics which treats of the relation, properties, and measurement of solids, surfaces, lines, and angles.

**GOLDEN NUMBER.**—The number denoting the year of the cycle of 19 years, in which the year in question falls. **To find the golden number for any year,** Add 1 to its number in the Christian year, and divide the sum by 19; the remainder is the golden number of the year, unless the remainder is 0, in which case the golden number is 19; thus 1854+1=1855;

dividing 1855 by 19, the remainder is 12; hence, 12 is the golden number required.

**GOLDEN RULE.**—A name sometimes given to the Rule of Three, on account of its great practical value and universal use. (See Rule of Three).

**GRAIN MEASURE.**—To find the quantity of grain in a bin, wagon-bed, etc., Multiply the height, length, and breadth together, in inches, and divide by 2150.42; the quotient will be the number of bushels. To find the quantity of grain when heaped on the floor in the form of a cone—Square the depth and square the slant height, in inches; take their difference and multiply by the depth, and this product by .0005, the result will be the number of bushels. To find the quantity of grain when heaped against a straight wall, Square one-half the depth, and proceed as in last rule. (See Apples, Bushel, and Corn).

**GREATEST COMMON DIVISOR.**—See Common Divisor.

**GUNTER'S CHAIN.**—A chain used for the purposes of land surveying. It is 4 rods or 66 feet in length, divided into 100 links, each link 7.92 inches in length, every tenth one being marked for convenience in counting. The advantage of this mode of division is, that a square chain or a square link is a decimal fraction of an acre, and if the area of a piece of ground be found in square chains and links, it may at once be converted into acres by pointing off a suitable number of decimal places.

**HAY.**—To find the amount of hay in a mow or stack, Find the number of cubic feet, and divide by the number of cubic feet in a ton, as given under Hay under Weights and Measures.

**HECTO-GRAMME.**—A French weight of 100 grammes, equal to 3 oz. 8 drams 11.8848 grains.

**HECTO-LITRE.**—A French measure containing 100 litres, equal to 26 gallons 3 pints.

**HECTOMETRE.**—A French measure containing 100 metres, equal to 19 rods 4 yards 2 feet 7.019 inches.

**HEIGHT.**—Any distance estimated or measured upwards.

**HEMISPHERE.**—One of the two equal parts of a sphere, made by passing a plane through its centre.

**HEPTAGON.**—A polygon of seven angles, or seven sides. To construct a regular heptagon, Divide the circumference of a circle into seven equal parts, and draw the chord subtending each arc.



**HEXAGONAL.**—Having six angles,

**HEXAGON.**—A polygon of six angles or sides. To inscribe a regular hexagon in a circle, Apply the radius six times as a chord, the resulting figure will be a regular hexagon.



**HEXAEDRON.**—A polyhedron of six faces, the same as a cube.

**HOGSHEAD.**—A measure of capacity, equivalent to 63 gallons of wine, or 54 gallons of beer. When used for tobacco, it varies in the different States from 750 to 1200 pounds.

**HORIZONTAL.**—Parallel to the horizon. A horizontal line is one parallel to the horizon, or to the surface of still water.

**HOURLY.**—A period of time equal to one-twenty-fourth part of a day, or 60 minutes.

**HYPOTHENUSE.**—The side of a right-angled triangle opposite the right angle, as AC. In a plane triangle the square described upon the hypotenuse is equivalent



to the sum of the squares described upon the other two sides.

**IMPROPER FRACTION.**—A fraction whose denominator is less than its numerator, as  $\frac{5}{3}$ . (See Fraction).

**INCH.**—A measure of length equal to the twelfth part of a foot. The length of a simple pendulum, which beats seconds in the Tower of London, is taken as the unit, and an inch is  $\frac{39.13909}{1000}$  of this. This is, in the City Hall of New York, equal to  $\frac{39.10140}{1000}$  of a simple seconds pendulum. The length of the seconds pendulum serves as the basis of a system of weights and measures.

**INCLINED PLANE.**—A rigid surface, sloping at an angle between the horizontal and vertical. To find the weight which can be raised on the inclined plane, Multiply the power by the length of the inclined plane, and divide the product by its perpendicular height.

**INCOMMENSURABLE.**—With respect to each other, two quantities

of the same kind are incommensurable when they do not have a common unit; i.e., when there is no quantity so small that it will be contained in both an exact number of times. Thus, the diagonal and the side of a square are incommensurable.

**INDEFINITE.**—Unlimited or unbounded. A line is indefinite if it is not limited by points, and space is indefinite in all directions, unless limited by a surface. When the number of terms in a series is unlimited, as 4, 7, 10, etc., an *infinitum*, it is called an indefinite series.

**INDEX.**—A number written over the radical sign to denote the degree of the root to be extracted. Thus, 3 in the above denotes that the cube root of 125 is to be extracted.

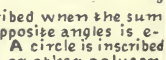
**INFINITY.**—A term used to express a quantity greater than any assignable quantity of the same kind. It is also the limit or last term of the series of natural numbers in an arithmetical progression. It is designated by the symbol  $\infty$ .

**INSCRIBE.**—To draw within, as one figure within another.



A straight line is inscribed in a circle when its two extremities lie in the circumference, as AB in the circle ABCD. An angle is inscribed when its vertex lies in the circumference, and when its sides form chords of the circle, as ABC, BCD, etc. A polygon is inscribed in a circle when all the vertices of its angles lie in the circumference, as ABCD, ABC, BCD, etc.

All regular polygons may be inscribed in a circle. A quadrilateral



may be inscribed when the sum of any two opposite angles is equal to  $180^\circ$ . A circle is inscribed in a triangle or other polygon, when it is tangent to every side of the polygon, as the circle FGH in the polygons ECB and ABCD.

A circle can always be inscribed in any triangle, and in any quadrilateral, when the sum of two opposite sides is equal to the sum of the other two opposite sides. The square and rhombus are the only parallelograms in which a circle can be inscribed. A polyhedron may be inscribed in a sphere, when the surface of the sphere passes through all its vertices. A sphere may be inscribed in any regular polyhedron, and also in any triangular pyramid.

To find the side of an inscribed equilateral triangle, Multiply the diameter by .866025, or the circumference by .275664. To find



the side of an inscribed square. Multiply the diameter by .10106, or the circumference by .25509.

**INSURANCE.**—For definitions, see under Business Terms. The amount of insurance corresponds to the base (in Percentage), the rate of premium to the percent., and the premium to the percentage. To find the face value of a policy that shall insure both the property and the premiums, Divide the amount of insurance required on the property by the difference per cent. of the rate of insurance. Most of the ordinary problems referring to insurance are simple problems in percentage, and require no further explanation.

**INTEGER.**—A whole number, as 3, 7, 20, etc., as distinguished from a fraction.

**INTEREST.**—Compensation for the use of money or value. The sum for the use of which interest is paid, is the *Principal*. The number of hundredths of the principal that is paid for its use, is the *Rate*; as 6% is  $\frac{6}{100}$ . The sum of the principal and interest, is the *Amount*. Interest on the principal only, is *Simple Interest*. Interest on the principal and on interest for a previous period, is *Compound Interest*. Interest computed by the rate established by law, is *Legal Interest*. Interest greater than legal interest, and prohibited by law, is *Usury*. When no rate is mentioned, the legal rate is always understood. (For the legal rate in the different States, see under Statistical Bureau of the United States). To find the time between two dates, omit the day of the date and include the day of maturity. (See Business Time Tables; see also Time, under Business Terms). For a quick and easy method of computing simple interest, without the use of fractions, see Instantaneous Method of Computing Interest. From this method, the interest on any sum, for any time and rate, may be found by simply adding the results obtained mentally from the tables.

To find the interest at any rate per cent. per annum for any given time, Multiply the principal by the rate, expressed as a decimal; the product will be the interest for 1 year. Multiply this interest by the time expressed in years and fractions of a year; the result will be the interest required. Or, Find the interest for the years as above, and take aliquot parts for the months and days. The following brief rules may be preferred by some persons: At 4 per cent., Multiply the prin-

cipal by the number of days, cut off the right-hand figure and divide by 9. At 5 per cent., Multiply by the number of days and divide by 72. At 6 per cent., Multiply by the number of days; cut off the right-hand figure and divide by 6. At 8 per cent., Multiply by the number of days and divide by 45. At 9 per cent., Multiply by the number of days; cut off the right-hand figure and divide by 4. At 10 per cent., Multiply by the number of days and divide by 36. For time at which money doubles at different rates of interest, see Time at which Money Doubles, etc., under Weights and Measures. To find the *Principal*, when the time, rate per cent., and interest are given, Divide the given interest by the interest on ONE DOLLAR for the given rate and time. To find the *Rate* per cent., when the principal, time, and interest are given, Divide the given interest by the inter-



est on the principal at ONE per cent. To find the *Time*, when the principal, rate, and interest are given, Divide the given interest by the interest on the principal for ONE DAY; the quotient will be the required time, in days. To find the *Principal*, when the time, rate, and amount are given, Divide the given amount by the amount of ONE DOLLAR for the given rate and time.

**INTERIOR.**—Lying on the inner side. An *interior angle* of a polygon is an angle included between two adjacent sides and lying within the polygon.

**INTERMEDIATE TERMS.**—In a progression, all the terms except the first and last, which are called extremes.

**INTERSECT.**—To pass through or cut each other. Two lines intersect when they cross each other, and have one point in common. Two surfaces intersect when they cut each other, and have a line, or lines, in common.

**INVERSE.**—Two processes or operations are said to be *inverse*, when one is exactly contrary to the other, or when being performed in succession upon a given quantity, the result will be that quantity; as Addition and Subtraction are inverse operations. For *Inverse Proportion*, see Proportion.

**INVERSION.**—The act or operation of changing the order of the terms. Thus, in the proportion, 3 : 9 :: 5 : 15, by inversion it is 9 : 3 :: 15 : 5. For *Inversion of Series*, see Series.

**INVERT.**—To turn or place in a contrary position. Thus the fraction  $\frac{3}{4}$  becomes  $\frac{4}{3}$  when inverted.

**INVESTMENTS AND DIVIDENDS.**

To find what rate of income will be derived from any given investment, Multiply the income by 100, and divide the product by the amount invested. To find the rate of dividend, Multiply the dividend by 100, and divide by the par value of the stock. To find what rate must be obtained, that a given sum invested may bring a given income, Multiply the given income by 100, and divide the product by the sum invested. To find the dividend on any given number of shares of stock, Multiply the par value of the stock by the rate of dividend, and divide the product by 100. To find what must be paid for stock purchased through a broker, Multiply the bonds or shares by the rate, and add the brokerage. If purchased on a credit of more than 3 days, add interest for the whole time. To find what sum must be invested that a given income may be obtained, Divide the required income by the rate of income per share, or per \$100, for the number of shares or bonds required, and multiply the quotient by the given price. To find the par value, when the premium or discount is given, Divide the given value of the stock by 1 increased by the rate per cent. of premium, or diminished by the rate per cent. of discount. The following table shows the rate of interest received on Stocks purchased from 25 per cent to 25 per cent premium:

Purchase	Rate	Received	on Stock	Bearing	Int.	At
Price.	5%	6%	7%	8%	10%	
75.	6.666	8.000	9.333	10.666	13.333	
80.	6.250	7.500	8.750	10.000	12.500	
85.	5.882	7.143	8.235	9.411	11.764	
90.	5.555	6.666	7.777	8.888	11.111	
95.	5.263	6.316	7.263	8.421	10.526	
97.5	5.128	6.156	7.179	8.205	10.256	
100.	5.000	6.000	7.000	8.000	10.000	
105.	4.761	5.714	6.666	7.619	9.523	
110.	4.545	5.454	6.363	7.272	9.090	
115.	4.347	5.130	6.086	6.956	8.695	
120.	4.166	5.000	5.833	6.666	8.333	
125.	4.000	4.800	5.600	6.400	8.000	

**INVOLUTION.**—Operation of finding any power of a given quantity. It is the reverse of evolution, and is performed by continued multiplication. A *power* is the product obtained by involution. The *root*, or *first power*, is the number multiplied. The different powers derive their name from the number of times the root is taken as a factor. The number denoting the power to which the root is to be raised, is the *index* or *exponent* of the power. It is placed on the right a little higher than the root. Thus,  $2^1=2$ , the 1st power of 2;  $2^2=2 \times 2=4$ , the 2d power, or square, of 2;  $2^3=2 \times 2 \times 2=8$ , the 3d power, or cube, of 2;  $2^4=2 \times 2 \times 2 \times 2=16$ , the 4th power of 2; etc. To find any given power of a number, Multiply the number by itself, till it is used as a factor as many times as there are units in the index of the power.

**ISOSCELES.**—A term applied to a triangle, when two of its sides are equal. Thus, in the triangle ABC, AB and AC being equal, the triangle is *isosceles*. In an *isosceles* triangle, the angles opposite the equal sides are equal, and a line drawn from the vertex of the equal sides, to the middle point of the base, is perpendicular to the base, it bisecting the base, and also the angle at the vertex.

**KILO-GRAMME.**—A French weight of 1000 grammes, equal to 2½ pounds avoirdupois.

**KILO-LITRE.**—A French measure of 1000 litres, equal to 264 gallons 1 pint 1.9638 gills.

**KILO-METRE.**—A French measure of 1000 metres, equal to about ¾ of a mile.

**LATERAL.**—Relating to the side. The lateral faces of a prism are those which have a side lying in the perimeter of each base; the lateral faces of a pyramid are those which meet at the vertex.

**LATITUDE.**—The angular distance of a place, on the surface of the earth, from the equator, measured on the meridian of the place. (See Degree).

**LEAST COMMON MULTIPLE.**—The least common multiple of two or more numbers, is the least number that can be divided by each without a remainder. Thus 35 is the least common multiple of 5 and 7. To find the least common multiple of two or more numbers, Write  $\begin{matrix} 2 & 14 & 10 & 12 & 14 \\ & 2 & 5 & 3 & 7 \end{matrix}$  the numbers in a line, and divide by any prime divisor of two or more of them, writing the quotients and undivided numbers underneath.

Divide these resulting numbers by any prime divisor of two or more of them, and so continue until no two of the resulting numbers have a common prime divisor. The product of the divisors and the last resulting numbers will be the least common multiple required. To find the least common multiple of several fractions, Reduce them to their lowest terms; then write the L.C.M. of their numerators over the G.C.D. of their denominators.

**LENGTH.**—One of the three attributes of extension, generally the greatest horizontal dimension of a body.

**LEVEL.**—A surface is said to be level when it is concentric with, or parallel to, the surface of the sea.

**LEVER.**—A solid bar turning upon a pivot, which is called its fulcrum. To find the weight which can be moved by a lever, no account being taken of the weight



of the lever, Multiply the power by its distance from the fulcrum, and divide by the distance of the weight from the fulcrum.

**LIFE.**—Of 100 lives, equally good, any one may expect to live 61½ years. This period is called the *probable* life. The mean duration of life is found from the tables of mortality, which give out of a certain number born, the number living at each successive birthday. (See Carlisle Table of Mortality, under Weights and Measures).

**LIFE ANNUITY.**—See Annuity. To find the final value of an annuity at simple interest, Multiply the interest on the annuity for 1 year by the number of years less 1, and this product by one-half the number of years. Then add the product of the annuity multiplied by the number of years. Example.—What will be the amount or final value of an annuity of \$100 for 8 years at 8%? Solution.—Interest on \$100 for 1 year = \$8;  $8 \times 7 = 42$ ;  $42 \times 4 = 168$ ;  $100 \times 8 = 800$ ;

$168 + 800 = \$968$  Ans. To find the present value of an annuity at simple interest, Find the final value of the annuity, and then find the present value of that amount. To find the final value of an annuity at compound interest, Multiply the amount of \$1, as given in Table 4 (of the Compound Interest Tables), by the annuity; the product will be the final value. To find the present value of an annuity at compound interest, Multiply the present worth of \$1, as given in Table 3 (of the Compound Interest Tables), by the given annuity. To find the present value of an annuity in reversion, Find the present worth of the final value of the annuity from the present time to the time it terminates. Example.—A father leaves an income of \$500 per year to his son, to commence in 5 years and to continue for 10 years. What is the present worth of the legacy, at 6 per cent. P. Solution.—By Table 3, present worth of \$1 for 15 yrs., \$9.7122  
 " " \$1 " 5 " 4.2123  
 \$5.4999

$\$5.4999 \times 500 = \$2749.94$  Ans.

**LINE.**—A magnitude which has the attribute of extension, called length, but neither breadth nor thickness. A *straight line* is one which does not change its direction between any two of its points, as —. A *curved line* is one which changes its direction at every one of its points, as —. A *broken line* is one made up of limited straight lines lying in different directions, as —.

**LINEAR.**—Relating to a line. A *linear unit* is a standard measure of length, as an inch, foot, yard, etc.

**LINK.**—A unit of measure equal to the hundredth part of Gunter's chain (which see), which is 7.92 inches.

**LIQUID MEASURE.**—Used for the measurement of liquids, such as liquors, molasses, water, etc. For Table, see under Weights and Measures.

**LIQUIDS, PRESSURE OF.**—The area (a) of the base of a regular vessel, the height (h) of the fluid in feet, and the weight (w) of a cubic foot of the fluid being given; required the pressure (p) in pounds on the bottom of the vessel: Formula.— $axh \times w = p$ . The height (h) of a column of fluid in feet, and the weight of a cubic foot of the fluid being given; required the pressure (p) in pounds of the column per square inch: Formula.— $h \times w + 144 = p$ . The diameter in feet of the base (b) of a cylindrical reservoir, and the depth in feet (d) of fresh water



contained therein being given; required the pressure (p) in pounds upon the staves:  $\text{Formula.} - b \times 3.1416 \times d \times (d+2) \times 62.5 = p$ .

**LITRE.**—A French measure of capacity, whose volume is equal to a cube whose edge is  $\frac{1}{10}$  of a metre, and whose capacity is  $\frac{1}{1000}$  of a cubic metre. It is equal to 61.027 cubic inches.

**LOG.** and **LOG-LINE.**—An instrument, of the nature of a float, having a line of about 150 fathoms attached, for determining the velocity of a ship when passing through the water.

**LOGARITHMS.** (log.)—Are indices of powers. Every number may be regarded as some power of 10, which is called the base, and logarithms are the indices of these powers of 10, most of them being proper or improper fractions. Thus the index of logarithm of 1000 is 3, that is, 1000 is the 3d power of 10; the log. of 251.19 is about 2.4 or  $\frac{24}{10}$ , that is, 251.19 is the 10th root of the 24th power of 10;  $251.19 = 10^{\frac{24}{10}} = 10^{2.4}$ .

**LONGITUDE.**—The arc of the equator intercepted between the meridian of a place, and the meridian of some other place from which longitude is reckoned. Longitude is generally reckoned from the meridian of Greenwich (near London), but sometimes from the meridian of Washington. For the length of a degree of longitude for each degree of latitude, and for converting longitude into time, and vice versa, see Longitude, under Weights and Measures.

**LUMBER MEASURE.**—See Board Measure.

**MAGNITUDE.**—Anything that can be increased or diminished, as a line, surface, number, angle, time, space, etc.

**MARKING PRICES.**—For method of marking goods, see Marking Goods, under Business Terms. To change the price of goods, marking them higher or lower, at a certain per cent on the old price, find the difference between the old and new per cent. of gain or loss. Divide this by the old amount or difference per cent.; the quotient will be the per cent. advance or discount from the old price. Multiply the old price by the amount or difference per cent. just found, and the product will be the required price.

**Example.**—What advance or discount must be made on the price of cloth marked @ \$2.60 to secure a profit of 25% or 14% if the present price affords a profit of 20%? What is the required price?

Ans. @ \$2.73 or \$2.41.

**Operation.**

(20~28) + 1.20 = .05; \$2.60 x 1.05 = \$2.73.

(20~14) + 1.20 = .05; \$2.60 x .95 = \$2.47.

**MARINER'S MEASURE.**—Used in measuring distances at sea. For Table, see under Weights and Measures.

**MATHEMATICS.**—That science which treats of the relations and measurement of quantities, and of the operations and processes, by means of which these relations are ascertained.

**MEAN.**—Lying between, as the mean of two quantities. An *arithmetical mean*, or average of several quantities of the same kind, is their sum divided by their number. Thus the mean of 10, 12, 17, and 25 is  $\frac{64}{4}$  or 16. A *geometrical mean* of two quantities, is the square root of their product: thus the geometrical mean of 2 and 8 is  $\sqrt{16} = 4$ . The greater of the given quantities is as many times greater than the mean, as the mean is



greater than the less quantity. In an arithmetical progression, each term is an arithmetical mean between the preceding and succeeding terms. In a geometrical progression, each term is a geometrical mean between the preceding and succeeding terms.

**MEASURE.**—The extent or value of a quantity, in terms of another quantity of the same kind, taken as a unit of measure. The measure of a line is the number of linear units, as feet, yards, etc., which it contains. The measure of a surface is the number of square units of surface, as square feet, square yards, etc., which it contains. The measure of a volume is the number of cubic units, as cubic feet, etc., which it contains. (See any particular measure in its alphabetic order, or under Weights and Measures.)

**MECHANICAL POWERS.**—The mechanical powers are the lever, the wheel and axle, the pulley, the inclined plane, the wedge,

and the screw. See each in its proper order.

**MENSURATION.**—That branch of applied geometry which relates to the computing of the length of lines, the area of surfaces, and the volume of solids. For information concerning any particular subject under Mensuration, refer to it under its appropriate title. The following list of titles will aid in reference:

Acute	Frustum	Pyramid
Angle	Gauging	Potatoes
Applies, etc.	Grain	Prism
Area	Hay	Quadrilateral
Board Measure	Height	Radius
Chord	Heptagon	Rectilineal
Circle	Hexagon	Rhomboid
Circumference	Inscribe	Rhombus
Circular Ring	Lateral	Sector
Cistern	Length	Segment
Cone	Line	Solid
Concentric	Lumber	Sphere
Convex	Mechanical	Square
Concave	Nonagon	Surface
Corn	Obtuse	Trapezium
Cube	Octagon	Trapezoid
Cylinder	Parallel	Triangle
Decagon	Parallelogram	Undecagon
Diameter	Pentagon	Vertex
Dodecagon	Perimeter	Volume
Ellipse	Point	Weights, etc.
	Polygon	Width
		Zone

**MERIDIAN.**—The meridian of a place, is the intersection of the surface of the earth, with a plane passing through the axis of the earth and the place. It is the same as a north and south line.

**METRE.**—A French measure of length, equivalent to the ten millionth part of the distance from the equator to the north pole, or about 39.37 inches.

**METRIC SYSTEM.**—The French system of denominate numbers, having for its fundamental unit the Metre, and having 10 as the constant ratio in its scale of notation. (See Metric System, under Weights and Measures.)

**MIDDLE.**—In a straight line, the middle point is the point which is the same distance from the two extremities; in general, it implies equidistant from the extremes.

**MILL.**—In the money of the United States, the unit of the lowest denomination, and is equal to the tenth part of a cent, or the thousandth part of a dollar.

**MILLION.**—A number written thus 1,000,000. It is a thousand thousand.

**MINUEND.**—In Subtraction, the quantity from which another is to be taken.

**MINUS.**—The sign of subtraction. It is a horizontal mark, thus —. The number at its right is taken from the one at its left.

**MINUTE.**—In time measure, the 60th part of an hour, or 1440th part of a day. In angular measure, the 60th part of a degree, or 5400th part of a right angle.

**MIXED NUMBER OR QUANTITY.**—A number or quantity consisting of both integral and fractional parts, as  $10\frac{1}{4}$ , or 10.25. All mixed numbers or quantities can be reduced to the form of simple fractions.

**MOMENTUM.**—The quantity of motion in a body. To find momentum, Multiply the weight by the velocity. Thus, the momentum of a body weighing 25 lbs. and moving at the rate of 80 feet per second, is 2000 lbs., i.e., it is equal to the momentum of a body weighing 2000 lbs. and moving one foot per second.

**MONEY.**—For table of U.S. Money, and for the value of foreign coins, see under Weights and Measures.

**MONTH.**—The twelfth part of a year. The number of days in each of the calendar months is shown in the Perpetual Calendar. The number of days from any day of any one month to the same day of any other month, is shown under Business Time Tables. A lunar month embraces the period between two consecutive new moons, and is about 29½ days in length. (See Time Table, under Weights and Measures).

**MULTIPLE.**—A multiple of any number is a number which it will exactly divide, as 24 is a multiple of 2, 3, 4, 6, 8, and 12. (See Least Common Multiple).

**MULTIPLICAND.**—In Multiplication, the quantity which is to be repeated or multiplied.

**MULTIPLICATION.**—The operation of finding the product of two quantities. The product is the quantity obtained by multiplying. The multiplier is the quantity denoting how many times the multiplicand is taken. The multiplicand is the quantity to be multiplied. To prove the accuracy of the operation, (1) Reverse the factors; (2) Divide the product by one of the factors; the quotient should be the other; (3) Find the excess of 9's in each of the factors, whether two or more. Then find the excess in the product of the excesses in the factors; this should equal the excess in the entire product. Example.—Multiply 23045 by 70800.

Operation.  
 23045      5 Excess.  
 70800      6  
 184360      3  
 161315      3  
 Prod. 1631586000      9  
 Contractions.—To multiply

by 10, 100, 1000, etc., Annex to the multiplicand as many ciphers as there are ciphers in the multiplier. To multiply by a convenient part of 10, 100, 1000, etc., as  $3\frac{1}{2}$ ,  $12\frac{1}{2}$ ,  $16\frac{1}{2}$ ,  $33\frac{1}{2}$ , etc., Multiply by 10, 100, 1000, etc., and divide the product by the number of times the multiplier has been increased. Thus, to multiply 459 by  $33\frac{1}{2}$ , annex two ciphers, and divide by 3. To multiply when the multiplier is 3 figures, 2 of which can be evenly divided by the third, then only two partial multiplications need be used. Thus, to multiply 47123 by 328 and by 832:

47123	47123
328	832
376984	376984
157936	1507936
15456344	39206336

first multiply by 8 in each case, and then multiply that product by 4 (which is equivalent to multiplying the original number by 32). In multiplying by 8 in each case,



put the first figure of the product under the 8, and in multiplying by 4 (32), place the first figure of the product under the 2 of the 32. To multiply 2 figures by 11, Place the sum of the figures between the figures; thus, 45 11 = 495. To multiply by 5, Add one 0, and divide by 2; to multiply by 15, do the same, and then add the quotient to the dividend; to multiply by 25, add two 0's, and divide by 4; to multiply by 75, do the same, and then subtract the quotient from the dividend. To multiply by any number ending with 9, Multiply by the next higher number, and subtract the multiplicand.

**MULTIPLIER.**—In Multiplication, that factor of a product which indicates the number of times which the other factor is to be taken.

**NAUTICAL.**—Pertaining to navigation. A nautical mile is the 60th part of a degree of latitude; it is equal to 69½ English miles.

**NEGATIVE.**—A term applied to a quantity preceded by the negative or minus sign, thus -140. A result affected by the minus sign, is to be interpreted in a sense exactly contrary to what it would have been interpreted, had it not been preceded by the minus sign, or by the positive sign (the plus sign +). The operations indicated by the signs + and - are diametrically opposed to each other, and if a quantity in any particular sense is considered positive, in the opposite sense it should be regarded as negative.

**NINE.**—Among the remarkable and valuable properties of the number 9, is that made use of in proving the accuracy of certain operations in arithmetic, by casting out the 9's, or by finding the excess of 9's. For an explanation of this property, see Addition, Subtraction, Multiplication, and Division.

**NOTATION.**—The art of representing or expressing mathematical quantities and operations by means of symbols. The two methods of expressing numbers, in general use, are the Arabic and the Roman. **Arabic Notation.**—By this method numbers are expressed by one or more of ten characters or figures. These are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. **Roman Notation.**—By this method numbers are expressed by one or more of seven capital letters. These are I, denoting one; V, five; X, ten; L, fifty; C, one hundred; D, five hundred; M, one thousand. Repeating a letter repeats its value, as III = 3, etc. Annexing a letter to another letter of greater value, adds the two. VI denotes V + I = 6. Prefixing a letter to another of greater value, indicates their difference, as IV denotes V - I = 4. A dash or vinculum placed over a letter, denotes a thousandfold its value, as V̄ = 5000; XXV̄ = 25,000. The following table contains the principal combinations of Roman numerals:

TABLE.			
I = 1	XVII = 16	C = 100	
II = 2	XVIII = 17	CX = 110	
III = 3	XIX = 18	CC = 200	
IV = 4	XX = 20	CCC = 300	
V = 5	XXI = 21	CD = 400	
VI = 6	XXII = 22	D = 500	
VII = 7	XXIII = 23	DC = 600	
VIII = 8	XXIV = 24	CCX = 210	
IX = 9	XL = 40	M = 1000	
X = 10	L = 50	MD = 1500	
XI = 11	LX = 60	MDC = 1600	
XII = 12	LXX = 70	MDCC = 1700	
XIII = 13	LXXX = 80	MDCCC = 1800	
XIV = 14	LXXXI = 81	MM = 2000	
XV = 15	XC = 90	MMM = 3000	



**NUMBER.**—Quantity conceived as made up of parts, or the measure of the relation between quantities of the same kind, and answerable to the questions, “How many?” Thus, distance is a quantity; but distance is called *number*, the notion is converted into *number*. A *number* is an expression for one or more units. An *integral number* consists of entire or whole units, as 1, 7, 16, etc. A *fractional number* consists of parts of units, as  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{11}{10}$ , etc. A *mixed number* consists of integral and fractional units being combined, as  $4\frac{1}{2}$ ,  $16\frac{2}{3}$ , etc. A *concrete or denominate number* consists of concrete units, as 1 pen, 6 oxen, 100 bushels, etc. An *abstract number* consists of abstract units, as 1, 5, 17, etc. A *simple number* consists of units of only one kind, as 10, 25 pounds, \$75, etc. A *compound number* consists of units of different kinds, as 15 pounds 10 ounces, 2 miles 10 rods 6 feet 4 inches. A *prime number* is one which cannot be exactly divided by any other number except 1, as 11, 17, 1999, etc. A *composite number* is one consisting of the product of the factors of other numbers as 4, 25, 192, etc.

**NUMERALS.**—The characters by means of which numbers are expressed, as *figures* in the Arabic notation, and *letters* in the Roman.

**NUMERATION.**—The art of reading numbers, when expressed by means of numerals. For the convenience of reading numbers, they are separated into periods of three places each as per table.

number of fractional units that are taken. (See Fraction).

**OBULATE**.—Flattened or depressed. If an ellipse be revolved about its minor axis, the volume generated is called an *oblate spheroid*. The earth being flattened at the poles, and protruded at the equator, is in the form of an oblate spheroid.

**OBlique.**—Deviating from the perpendicular. Thus the line BD is oblique to the line AC. An oblique angle is one either greater or less than a right angle, the angles DBA and DBC both being oblique angles. An oblique triangle is one in which all the angles are oblique. An oblique cylinder or cone is one whose axis is oblique to the plane of its base.

**OBLONG.**—A rectangle whose adjacent sides are unequal. In general, any body or volume which is longer than it is wide.



equal to each other. The angle at the center,  $\angle ACB$ , is  $45^\circ$ , and the angle at the vertex of any angle,  $\angle ACD$ , is  $135^\circ$ . The area of a regular octagon, whose side is 1, is equal to 4.8284271.


**OCTAGONAL.**—Pertaining to an octagon.

**OCTANGULAR.**—Having eight angles.

**OCTANT.**—The half of a quadrant, or the eighth part of a circumference of a circle.

**ODD.**—Not divisible by 2 without a remainder. The alternate numbers beginning at 1, as 1, 3, 5, 7, etc., form the series of odd numbers.

**OPERATION.**—Something to be done, as a transformation to be made upon quantities. Such transformation is indicated either by rules or by symbols. (See Symbol).

**OPPOSITE ANGLES.**—Angles lying on opposite sides of two intersecting lines. Thus, the angles ACD and ECR are opposite.

**OUNCE.**—A unit of weight. In avoirdupois weight, it is the sixteenth part of a pound, and contains  $437\frac{1}{2}$  grains; in Troy weight, it is the twelfth part of a pound, and contains 480 grains.

**OVAL.**—A figure resembling an ellipse, or egg-shaped.

**PAR VALUE.**—The full value represented on the face of a note, bond, or other certificate of property. (See Par, under Business Terms).

**PARALLEL.**—Having the same direction, and equidistant in all parts. Two straight lines are parallel to each other, when they lie in the same


## NUMERATION TABLE

[illegible]

**To read any number, Determine the order and name of each significant figure in the number to be read; then begin at the left hand and name the significant figures in each period, together with their relative unit value, and add the name of the period.**

**NUMERATOR.**—The term of a fraction which indicates the


**OBTUSE.**—Not pointed.  
ed. sharp. OR ACUTE.



The diagram shows a horizontal line with a point on it. A vertical dashed line extends upwards from this point, labeled 'E'. Another line extends upwards and to the right from the same point, labeled 'D'. The angle between the horizontal line and line 'D' is an obtuse angle.

An obtuse angle is an angle greater than a right angle, as ABD.

**OCTAGON.**—A polygon of eight sides or angles. A regular octagon is one whose sides and angles are respectively



direction, and are therefore contained in the same plane, a rigid body cannot touch or intersect how far soever they be extended. Three or more straight lines are parallel to each other when they have the same direction. Two or more circles are said to be parallel to each other when they are concentric.



**PARALLELOGRAM.**—A quadrilateral whose opposite sides are parallel, and also equal. If one angle of a parallelogram is a right angle, all the other angles are also right angles, and the parallelogram is a rectangle, as *ABCD*. If two adjacent sides of a parallelogram are equal, the figure is a rhombus; if, in addition, the included angle is a right angle, the figure is a square. If a parallelogram is oblique-angled, it is a rhomboid, *EFGD*. The area of a parallelogram is equal to the product of its base by its altitude.



**PARALLELOPIPEDON.**—A polyhedron bounded by six parallelograms. The solid is a rectangular parallelepipedon, if the parallelograms are rectangles. If they are squares, it is a cube. The area of a parallelepipedon is equal to the product of its length, breadth, and thickness.



**PARTIAL PAYMENTS.**—Payments made at different times of part of a note, bond, or other obligation. These payments should be indorsed upon the back of the note, bond, etc. The following rule for computing interest when partial payments have been made has been adopted by the Supreme Court of the United States, and by several of the States, and is called

#### The United States Rule.

*I.* The rule for casting interest when partial payments have been made, is to apply the payment, in the first place, to the discharge of the interest due. *II.* If the payment exceeds the interest, the surplus goes towards discharging the principal, and the subsequent interest is to be computed on the balance of the principal remaining due. *III.* If the payment be less than the interest, the surplus of interest must not be taken to augment the principal; but interest continues on the former principal until the period when the payments, taken together, exceed the interest due, and then the surplus is to be applied towards discharging the principal, and interest is to be computed on the balance as aforesaid.

Among merchants where it is customary to make settlements yearly, or oftener, the following rule is much used by them, and is called

#### The Merchants' Rule.

*I.* Find the interest on the principal from the time it becomes due to the time of settlement, and add it to the principal. *II.* Find the interest on each payment from the time it was made to the

time of settlement, and add the sum of the interest thus found to the sum of the payments. *III.* Deduct the sum of the payments and the interest thereon from the amount of principal and interest, and the difference will be the balance due.

The Vermont Rule is the same as the Merchants' Rule, except in the latter, settlement is made not later than a year after the date of the note, while in the former, settlement is not made until the final adjustment of the account, which may be less than a year, or many years. The difference between any two of the three rules may be seen from the following Example:—A note of \$1000 runs 4 years at 8% interest, on which were made quarterly payments of \$50. What was the amount due at settlement?

By the United States Rule,	\$440.82
" Merchants'     "	432.23
" Vermont     "	400.00



It will be seen by the above example that, for periods longer than one year, the United States Rule is most favorable to the creditor, then the Merchants' Rule, after which the Vermont Rule; while they favor the debtor in the opposite order.

**PARTNERSHIP.**—For definitions and forms, see under Business Forms and Terms. To find each partner's share of the gains or losses, when the shares are in proportion to the investments, Place the amount invested by each partner as a numerator, and the whole capital of the firm as a denominator: the several fractions will express each partner's share. Then multiply the gain or loss by the fraction expressing each partner's share, and the product will be his share of the gain or loss. Example.—A, B, and C formed a partnership. A invested \$6000, B \$5000, and C \$3000. Their prof-

its were \$5600, to be divided in proportion to their capital. What was each partner's share?

#### Operation.

\$6000 + \$5000 + \$3000 = \$14000, Firm's capital.
$\frac{6000}{14000} = \frac{3}{7}$ , A's share, $5600 \times \frac{3}{7} = \$2400$ , A's gain.
$\frac{5000}{14000} = \frac{5}{14}$ , B's, $5600 \times \frac{5}{14} = \$2000$ , B's, "
$\frac{3000}{14000} = \frac{3}{14}$ , C's, $5600 \times \frac{3}{14} = \$1200$ , C's, "

Another method is To multiply each partner's capital by the percentage which the gains or losses may be of the capital of the firm. Thus

\$5600 = 40% of \$14000.
\$6000 x 40% = \$2400, A's gain.
\$5000 x 40% = \$2000, B's, "
\$3000 x 40% = \$1200, C's, "

To find each partner's interest at closing: *I.* Find the firm's net capital or net insolvency at commencing and at closing. *II.* Find the firm's net gains or net losses, and each partner's share. Then, *III.* To each partner's original investment add any additional investments or sums to which he may be entitled, and his share of the net gains, if any; also deduct the amounts withdrawn by him, and obligations assumed by the firm for him, and his share of the net losses, if any. If the original agreement entitles him to any other sum, or makes him responsible to the firm for any sum, add or subtract, as the case may be.

#### PENTAGON.

A polygon of five sides or five angles. A regular pentagon is one whose sides and angles are all equal each to each, and may be inscribed in a circle.



**PENNY-WEIGHT.**—A unit in Troy weight, equivalent to  $\frac{1}{20}$  of an ounce.

**PERCENTAGE.**—A general designation for all processes involving the method of reckoning by the hundred. The result obtained by taking a certain per cent. of a number is called the *Percentage*. The number on which the percentage is reckoned is called the *Base*. The sum of the base and the percentage is the *Amount*. The excess of the base over the percentage is the *Difference*. The number used as a multiplier in obtaining any required per cent. of a given number, is the *Rate*. To find the percentage, the base and rate being given, Multiply the base by the rate expressed decimally, or remove the decimal point two places to the left, and multiply the result



by the rate. **Example.**—What is 4 % of \$674.50?

1st Method.

\$674.50

.04

\$26.9800

2d Method.

\$674.50

.04

\$26.9800

To find the rate, the base and percentage being given, Annex two ciphers to the percentage and divide by the base. **Example.**—What rate per cent. of 400 is 24?  $2400 \div 400 = 6$ . Ans. 6 %.

To find the base, the rate and percentage being given, Annex two ciphers to the percentage and divide by the rate. **Example.**—What is the number of which 300 is 60 %?  $30000 \div 60 = 500$  Ans.

To find the base, the rate and the amount, or the rate and the difference being given, Divide the amount by 1 increased by the rate per cent. (expressed decimally). Divide the difference by 1 diminished by the rate per cent. (expressed decimally). **Examples.**—500 is 20 % more than what number?  $500 \div 1.20 = 500$  Ans.

What number diminished by 20 % of itself equals 400?  $400 \div .80 = 500$  Ans.

Formulas.

Per cent. = base  $\times$  rate per cent.

Rate per cent. = per cent.  $\div$  base.

Base = per cent.  $\div$  rate per cent.

Base =  $\frac{\text{Amount}}{\text{Difference} + (1 + \text{rate per cent.})}$

**PERCH.**—A unit of measure for surfaces. It is a square rod, and is equivalent to 80 square yards, or 72  $\frac{1}{2}$  square feet. It is used chiefly in land measuring.

**PERIMETER.**—The line that bounds a plane figure. In a polygon its length is equal to the sum of all the sides of the polygon.

**PERIOD.**—1st Numeration, a group of three orders, as Period of Units, Period of Thousands, etc. In Extraction of Roots, a number of figures considered together.

**PERMUTATION.**—The results obtained by writing any number of factors in every possible order, so that each shall enter every result and enter it but once. Thus, the two letters a and b can be placed in only two positions, ab and ba. The three letters a, b, and c can be placed in 6 different positions. The first four letters of the alphabet can be placed in 24 different positions, and the 26 letters of the alphabet admit of  $403291456126805635584000000$  different positions. To find any result in permutation, Multiply together the numbers, 1, 2, 3, 4, etc., from 1 to the given number; the last product will be the required result.

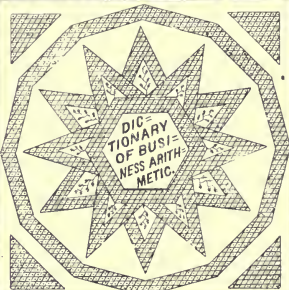
**PERPENDICULAR.**—One straight

line is perpendicular to another straight line when they meet so as to make the two angles formed equal. Thus AB and DC are perpendicular to each other. Straight lines and curved, straight lines and planes, planes and planes, etc., may be perpendicular to each other.



**PERPETUITY.**—The sum of money which will buy an annuity to last forever. To find any perpetuity, Multiply the annual payment by the reciprocal of the rate per cent. at which the perpetuity is computed. **Example.**—What is the value of a perpetuity of \$100 per annum at 5 %? **Solution.**— $5\% = \frac{5}{100} = \frac{1}{20}$ ; the reciprocal of  $\frac{1}{20} = 20$ ;  $\$100 \times 20 = \$2000$  Ans.

**PERSPECTIVE.**—Such a representation of an object upon a surface as shall present to the eye, situated at a particular point, the same appearance that the object itself would present, were



the surface removed.

**PILING SHOT.**—

Shot, shells, etc., are generally piled in regular piles of a pyramidal or wedged-shaped form. The piles are named from the form of their bases, square, rectangular, and triangular. To find the number of balls in any pile, Add to the number of balls in the longest side of the base the number in the parallel side opposite, and also the number in the parallel top row; multiply this sum by one-third of the number of balls in the triangular face of the pile, and the result will be the number of balls in the pile. **Example.**—How many balls in the above pile? **Solution.**—The number in the longest side of the base is 6; in opposite parallel side, 6; in parallel top row, 1; in triangular



face of pile, 21, one-third of which is 7;  $6 + 6 + 1 = 13$ ;  $13 \times 7 = 91$  Ans.

**PINT.**—A unit of measure, equivalent to  $\frac{1}{8}$  of a gallon, or 28  $\frac{1}{8}$  cubic inches.

**PLANE.**—A surface of such nature that, if any two points be taken and joined by a straight line, that line will lie wholly in the surface.

**PLUMB-LINE.**—A line, or string, having a weight attached, and used for the purpose of ascertaining a vertical direction.

**POINT.**—Position without extension, it having neither length, breadth, nor thickness.

**POLE.**—A unit of measure, equivalent to 16  $\frac{1}{2}$  feet, or 5  $\frac{1}{2}$  yards.

**POLYGON.**—A plane figure bounded by straight lines. These lines are called the sides of the polygon, and the points in which they meet are called vertices of the polygon. Polygons are classified according to the number of their sides or angles. The following table exhibits the angles and areas of all the polygons, up to the dodecagon, viz., the angle at the centre, the angle of the polygon, and the area of the polygon when each side is 1.

No. of Sides.	Name of Polygon.	Angle at centre.	Angle of Polygon.	Area
3	Triangle	120°	60°	0.4330127
4	Square	90°	90°	1.0000000
5	Pentagon	72°	108°	1.7204774
6	Hexagon	60°	120°	2.5980762
7	Heptagon	51 $\frac{3}{4}$ °	128 $\frac{1}{4}$ °	3.6399124
8	Octagon	45°	135°	4.8284271
9	Nonaagon	40°	140°	6.1818242
10	Decagon	36°	144°	7.6942088
11	Undecagon	32 $\frac{4}{11}$ °	147 $\frac{3}{11}$ °	9.3656399
12	Dodecagon	30°	150°	11.1961524

To find the area of any regular polygon, Square the side, and multiply that square by the area in that part of the fifth column of preceding table corresponding with the number of sides. To find the area of an irregular polygon of four or more sides, Divide the figure into triangles by diagonals connecting some one angular point with each of the others; then compute the area of each triangle, and find their sum.

**POLYHEDRON.**—A solid, whose sides or faces are polygons. The lines in which the faces meet are called edges, and the vertices of the polyhedral angles are called vertices of the polyhedron. A regular polyhedron is one whose faces are regular polygons.

**POSITIVE.**—A term applied to a quantity affected with the sign +. (See Negative).

**POUND.**—A unit of weight, as a pound Troy, a pound Avoirdupois, etc. A Troy pound contains 5760 grains, and an Avoirdupois pound, 7000 grains. A cubic inch

# TABLE OF PRIME NUMBERS TO 6000.

To use the table, look for the required thousand over one of the sub-tables, then under it look for the required hundred, following down the column, if the remaining figures of the number occur, it is prime; otherwise, not. *Example.*—3331 is prime; 3337, not.

0										1000									
1	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	3	2	1	1	1	1	1	1	1	2	3	2	1	1	1	1	1	1	1
3	7	2	1	1	1	1	1	1	1	1	7	2	1	1	1	1	1	1	1
5	9	2	1	1	1	1	1	1	1	5	9	2	1	1	1	1	1	1	1
7	13	3	3	1	1	1	1	1	1	7	13	3	3	1	1	1	1	1	1
11	17	3	3	1	1	1	1	1	1	11	17	3	3	1	1	1	1	1	1
13	19	3	3	1	1	1	1	1	1	13	19	3	3	1	1	1	1	1	1
17	23	3	3	1	1	1	1	1	1	17	23	3	3	1	1	1	1	1	1
19	29	3	3	1	1	1	1	1	1	19	29	3	3	1	1	1	1	1	1
23	31	3	3	1	1	1	1	1	1	23	31	3	3	1	1	1	1	1	1
29	37	3	3	1	1	1	1	1	1	29	37	3	3	1	1	1	1	1	1
31	41	3	3	1	1	1	1	1	1	31	41	3	3	1	1	1	1	1	1
37	43	3	3	1	1	1	1	1	1	37	43	3	3	1	1	1	1	1	1
41	47	3	3	1	1	1	1	1	1	41	47	3	3	1	1	1	1	1	1
43	49	3	3	1	1	1	1	1	1	43	49	3	3	1	1	1	1	1	1
47	53	3	3	1	1	1	1	1	1	47	53	3	3	1	1	1	1	1	1
53	59	3	3	1	1	1	1	1	1	53	59	3	3	1	1	1	1	1	1
59	67	3	3	1	1	1	1	1	1	59	67	3	3	1	1	1	1	1	1
67	71	3	3	1	1	1	1	1	1	67	71	3	3	1	1	1	1	1	1
71	73	3	3	1	1	1	1	1	1	71	73	3	3	1	1	1	1	1	1
73	79	3	3	1	1	1	1	1	1	73	79	3	3	1	1	1	1	1	1
79	83	3	3	1	1	1	1	1	1	79	83	3	3	1	1	1	1	1	1
83	89	3	3	1	1	1	1	1	1	83	89	3	3	1	1	1	1	1	1
89	97	3	3	1	1	1	1	1	1	89	97	3	3	1	1	1	1	1	1

2000										3000									
1	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	3	2	1	1	1	1	1	1	1	2	3	2	1	1	1	1	1	1	1
3	7	2	1	1	1	1	1	1	1	3	7	2	1	1	1	1	1	1	1
5	9	2	1	1	1	1	1	1	1	5	9	2	1	1	1	1	1	1	1
7	13	3	3	1	1	1	1	1	1	7	13	3	3	1	1	1	1	1	1
11	17	3	3	1	1	1	1	1	1	11	17	3	3	1	1	1	1	1	1
13	19	3	3	1	1	1	1	1	1	13	19	3	3	1	1	1	1	1	1
17	23	3	3	1	1	1	1	1	1	17	23	3	3	1	1	1	1	1	1
19	29	3	3	1	1	1	1	1	1	19	29	3	3	1	1	1	1	1	1
23	31	3	3	1	1	1	1	1	1	23	31	3	3	1	1	1	1	1	1
29	37	3	3	1	1	1	1	1	1	29	37	3	3	1	1	1	1	1	1
31	41	3	3	1	1	1	1	1	1	31	41	3	3	1	1	1	1	1	1
37	43	3	3	1	1	1	1	1	1	37	43	3	3	1	1	1	1	1	1
41	47	3	3	1	1	1	1	1	1	41	47	3	3	1	1	1	1	1	1
43	49	3	3	1	1	1	1	1	1	43	49	3	3	1	1	1	1	1	1
47	53	3	3	1	1	1	1	1	1	47	53	3	3	1	1	1	1	1	1
53	59	3	3	1	1	1	1	1	1	53	59	3	3	1	1	1	1	1	1
59	67	3	3	1	1	1	1	1	1	59	67	3	3	1	1	1	1	1	1
67	71	3	3	1	1	1	1	1	1	67	71	3	3	1	1	1	1	1	1
71	73	3	3	1	1	1	1	1	1	71	73	3	3	1	1	1	1	1	1
73	79	3	3	1	1	1	1	1	1	73	79	3	3	1	1	1	1	1	1
79	83	3	3	1	1	1	1	1	1	79	83	3	3	1	1	1	1	1	1
83	89	3	3	1	1	1	1	1	1	83	89	3	3	1	1	1	1	1	1
89	97	3	3	1	1	1	1	1	1	89	97	3	3	1	1	1	1	1	1

4000										5000									
1	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	3	2	1	1	1	1	1	1	1	2	3	2	1	1	1	1	1	1	1
3	7	2	1	1	1	1	1	1	1	3	7	2	1	1	1	1	1	1	1
5	9	2	1	1	1	1	1	1	1	5	9	2	1	1	1	1	1	1	1
7	13	3	3	1	1	1	1	1	1	7	13	3	3	1	1	1	1	1	1
11	17	3	3	1	1	1	1	1	1	11	17	3	3	1	1	1	1	1	1
13	19	3	3	1	1	1	1	1	1	13	19	3	3	1	1	1	1	1	1
17	23	3	3	1	1	1	1	1	1	17	23	3	3	1	1	1	1	1	1
19	29	3	3	1	1	1	1	1	1	19	29	3	3	1	1	1	1	1	1
23	31	3	3	1	1	1	1	1	1	23	31	3	3	1	1	1	1	1	1
29	37	3	3	1	1	1	1	1	1	29	37	3	3	1	1	1	1	1	1
31	41	3	3	1	1	1	1	1	1	31	41	3	3	1	1	1	1	1	1
37	43	3	3	1	1	1	1	1	1	37	43	3	3	1	1	1	1	1	1
41	47	3	3	1	1	1	1	1	1	41	47	3	3	1	1	1	1	1	1
43	49	3	3	1	1	1	1	1	1	43	49	3	3	1	1	1	1	1	1
47	53	3	3	1	1	1	1	1	1	47	53	3	3	1	1	1	1	1	1
53	59	3	3	1	1	1	1	1	1	53	59	3	3	1	1	1	1	1	1
59	67	3	3	1	1	1	1	1	1	59	67	3	3	1	1	1	1	1	1
67	71	3	3	1	1	1	1	1	1	67	71	3	3	1	1	1	1	1	1
71	73	3	3	1	1	1	1	1	1	71	73	3	3	1	1	1	1	1	1
73	79	3	3	1	1	1	1	1	1	73	79	3	3	1	1	1	1	1	1
79	83	3	3	1	1	1	1	1	1	79	83	3	3	1	1	1	1	1	1
83	89	3	3	1	1	1	1	1	1	83	89	3	3	1	1	1	1	1	1
89	97	3	3	1	1	1	1	1	1	89	97	3	3	1	1	1	1	1	1

of distilled water, at 62° Fahr., the barometer being 30 inches, weighs 252.458 Troy grains, which is taken as the varying standard of comparison. A *Pound* is also a unit of currency in the British, and several other foreign systems; the British pound sterling being equivalent to about \$4.86.

**POWER.**—See *Involution*. **PRACTICE.**—A concise and easy method of applying arithmetical rules to questions which occur in trade and business. It is a particular case in the use of aliquot parts and of the Rule of Three, in which the first term is 1. To solve any problem according to this method, Take the sum of such aliquot parts of the given number of things, as the given price is of the unit of currency of the next higher order, and the result will be the price of the thing in terms of that unit. *Example.*—Required the cost



of 24 yards of muslin at 12½ cts. per yard. *Solution.*—At \$1 a yard it is worth \$24.00. At 12½ cts. a yard it is worth only 1/8 of \$24.00, which is \$3.00.

**PRESENT WORTH.**—The Present Worth of a debt payable at a future time without interest, is that sum which, at a specified rate per cent. for the same time, would amount to the debt. To find the present worth, Divide the given debt by the amount of \$1.00 for the given time, at the given rate per cent. *Example.*—What is the Present Worth of \$224, due two years hence, without interest, money being worth 6% per annum? *Solution.*—The amount of \$1 for 2 years, at 6%, is \$1.12; so \$224 ÷ \$1.12 = \$200 Ans.

**PRIME.**—A number is prime when it cannot be exactly divided by any other number except 1. See the table at the left for all the prime numbers up

to 6000. The *Prime Factors* of a number, are the prime numbers that will exactly divide it. To resolve a number into its prime factors, see *Factor*.

**PRINCIPAL.**—The name given to a sum of money put out at interest. See *Interest*.

**PRINCIPLE.**—A self-evident truth, or one which has been proved.

**PRISM.**—A solid whose sides or faces are parallelograms, and whose ends or bases are equal and parallel polygons. A prism is triangular, quadrangular, pentagonal, etc., according as its bases are triangles, squares, pentagons, etc. To find the entire surface of any right prism, Multiply the perimeter, or circumference of the base, by the height, and to the product add the area of the two bases. To find the solidity of a prism, Multiply the area of the base by the perpendicular height.

**PROBABILITY.**—In the doctrine of chances, the likelihood of the occurrence of an event. If a small cube be thrown into the air, it will necessarily fall upon one of its six faces, and the probability of its falling upon any one face is said to be 1/6, and the probability that a given face will not turn up is 5/6. The following are different phases of probability: *I.* Probability of the occurrence of one event out of any given number. *II.* Probability of the simultaneous occurrence of two or more events. *III.* Probability of successive events occurring in any given order. *IV.* Probability derived from experience. (See *Expectation*.) To find the probability, Divide the number of favorable chances by the whole number of chances, both favorable and unfavorable, and the quotient (which is always in the form of a fraction) will be the probability.

**PROBLEM.**—A question proposed for solution. To solve a problem, is to find such a value or values as will satisfy the given conditions of the problem. To state a problem, is to translate the conditions of the problem into mathematical language.

**PROCESS.**—Course of proceedings or operations.

**PRODUCT.**—The amount or result obtained by taking one number or quantity as many times as there are units in another. The continued product of any number of factors is the result obtained by multiplying the first factor by the second, that result by the third, that by the fourth, etc., until all the factors have been used.



**PROFIT AND LOSS.**—Profit is any gain realized from an increase or appreciation of value in commodities, or any other property. Loss is the amount which the selling price of any commodity, or other property, is less than its cost; also any depreciation in value. **To find the gain or loss,** when the cost and rate per cent. are given, Multiply the cost by the rate per cent., expressed decimally. **Example.**—Cloth costing \$250, was sold at 15% advance. What was the gain? **Solution.**—\$250 x .15 = \$37.50. A bale of cotton costing \$80, was sold at 8% loss. What was the loss? **Solution.**—\$80 x .08 = \$6.40. **To find the rate per cent.** when the cost and gain or loss are given, Divide the gain or loss by the cost, and the quotient, expressed in hundredths, will be the rate per cent. **Example.**—Cloth costing \$4 a yard, was sold for \$5 a yard. What was the gain per cent.? **Solution.**— $\frac{\$1}{\$4}$  (the gain) ÷  $\frac{1}{4}$  (the cost) = .25 or 25%. **To find the cost** when the gain or loss and the rate per cent. are given, Divide the gain or loss by the rate per cent., expressed decimally. **Example.**—Cloth sold at a gain of 25%. What was the cost per yard? **Solution.**— $\frac{\$1.00}{.25} = \$4.00$ . **To find the cost** when the selling price and the rate per cent. of gain or loss are given, Divide the selling price by 1 plus or minus the rate per cent. **Example.**—Cloth sold at \$5.00 a yard, pays 25% profit: required the cost price per yard. **Solution.**— $\$5.00 \div 1.25 = \$4.00$ . **Ans. Formulas.**  
 Gain or loss = cost X rate %.  
 Rate per cent. = gain or loss ÷ cost.  
 Cost = gain or loss ÷ rate %.  
 Cost = selling price ÷ (1 + rate %).

**PROGRESSION.**—A series in which the terms increase or decrease according to a uniform law. **Arithmetical Progression** is a series which increase or decrease by a common difference. Thus, 1, 4, 7, 10, 13, etc., is an increasing series, while 20, 17, 14, 11, 8, 5, etc., is a decreasing series. The numbers forming the series are called **terms**; the first and last terms are the **extremes**, and the other terms, the **means**. **To find the sum of all the terms** of a series, when the extremes and number of terms are given, Multiply the sum of the extremes by the number of terms; half the product will be the sum of the series. **Example.**—How many strokes does the hammer of a

clock strike in 12 hours? **Solution.**—1 + 12 (the extremes) = 13;  $13 \times 12$  (number of terms) = 156;  $156 \div 2 = 78$ . **Ans.** **To find the common difference,** when the extremes and the number of terms are given, Divide the difference of the extremes by the number of terms less one; the quotient will be the common difference. **Example.**—The first term of a series is 3, the last 300, and the number of terms 10; what the com. dif.? **Solution.**— $300 - 3 = 297$ ;  $297 \div 9 = 33$ . **Ans.** **To find the last term,** when the first term, the common difference, and the number of terms are given, Multiply the common difference by the number of terms less one; if an increasing series, add the product to the first term; if a decreasing series, subtract the product from the first term. **Example.**—The first term of an increasing series is 2, the common difference 3, and the number of terms 50;



what is the last term? **Solution.**— $3 \times 49 = 147$ ;  $147 + 2 = 149$ . **Ans.** **A Geometrical Progression** is a series increasing by a constant multiplier, or decreasing by a constant divisor. Thus, 2, 4, 8, 16, 32, 64, etc., is an increasing geometric series, while 64, 32, 16, 8, 4, etc., is a decreasing geometric series. The constant multiplier or divisor is called the **ratio**. **To find the sum of all the terms** of a geometric series, Multiply the greatest term by the ratio; from the product subtract the least term, and divide the remainder by the ratio less 1. **Example.**—John Jones gave to his daughter on New Year's day \$1; he doubled it on the first day of every month for a year: what sum did she receive? **Solution.**—The ratio is 2; the least term 1; the greatest term 2048 (found by raising the common ratio to a power whose degree is one less than the number of terms, and multiplying the 1st term by it. ( $2^{11} \times 1 = 2048$ ;

$2048 \times 2 = 4096$ ;  $4096 - 1 = 4095$ ;  $4095 \div 1 = 4095$ . **Ans.** #4095.

**PROOF.**—Verification of a rule, or of the accuracy of an operation. In many operations a converse rule will verify the accuracy of the work. For proofs of Addition, Subtraction, Multiplication, and Division, see each of these subjects.

**PROPORTION.**—The relation which quantities of the same kind bears to another, with respect to magnitude or numerical value. An equality of ratios (see Ratio) is a **Proportion**. Thus, 3 : 6 :: 9 : 18 expresses that the ratio between 3 and 6 is the same as between 9 and 18, and is read, 3 is to 6 as 9 is to 18. The first and fourth terms are called the **extremes**; the second and third, the **means**. The product of the means always equals the product of the extremes. **Simple Proportion** (or Rule of Three) is an equality of two ratios, and consists of four terms. Three of the members of a proportion being given, two of them must be of the same kind, and the other must be of the same kind as the fourth term, or answer. Hence, **To find any required term** of a proportion, Place the number of the same denomination as the answer sought, for the third term. If the answer is to be greater than the third term, place the greater of the other two numbers for the second term, and the less for the first. If the answer is to be less than the third term, place the less of the other two numbers for the second term, and the greater for the first. Reduce, if necessary, the first and second terms to the same denomination, and if the third term is a compound number, reduce it to the lowest term mentioned in it. Then divide the product of the means by the known extreme, or divide the product of the extremes by the known mean; the quotient will be the term required. **Example.**—If 25 barrels of flour cost \$165, what will 35 barrels cost? **Solution.**— $25 : 35 :: \$165 : (\text{Answer})$ ;  $\$165 \times 35 = \$5775$ ;  $\$5775 \div 25 = \$231$ . **Ans.** **A Compound Proportion** is one which involves two or more simple ones. All of the terms of a compound proportion appear in couplets, except one, which is always of the same kind as the answer sought. **To find any required term** of a compound proportion, Write the number which is of the same kind as the answer sought, for the third term. Arrange the two terms of each ratio separately, as in simple proportion. Then, if an extreme term be required, it will be equal to the





thus obtained as before, and so proceed to the denomination required. The last quotient with the several remainders will be the answer. **Example.**—Reduce 4050 gills to gallons.

**Solution.**  
 $4\text{ gills} = 1\text{ pint. } 414050\text{ gills.}$   
 $2\text{ pints} = 1\text{ quart. } 211012\text{ pints and } 2\text{ gills.}$   
 $4\text{ quarts} = 1\text{ gallon. } 41506\text{ quarts.}$

126 gals. 2 qrs. and 2 gills.

**To reduce a denomination number to one of a lower order.** **I.** Multiply the number of the highest denomination by the number which one of this denomination makes of the next lower. **II.** Add to the product the number in the next lower denomination, if any. **III.** Proceed in the same way through the lower denominations to the one required. **Example.**—How many pints in 7 bushels, 3 pecks, 4 quarts, and 1 pint?

**Solution.**  
 $7\text{ bu.}, 3\text{ pk.}, 4\text{ qt.}, 1\text{ pt.}$   
 $1\text{ bushel} = 4\text{ pecks. } \frac{4}{31}\text{ pecks.}$   
 $1\text{ peck} = 8\text{ quarts. } \frac{8}{252}\text{ quarts.}$   
 $1\text{ quart} = 2\text{ pints. } \frac{2}{503}\text{ pints} = \text{Answer.}$

**To reduce a fraction of a higher, to one of a lower denomination, or to integers.** Multiply as in whole numbers, described above, according to the rules for the multiplication of fractions. (See *Fractions*.)

**Example.**—Reduce  $\frac{1}{2}$  of a gallon to integers of lower denominations.

**Solutions.**  
 $\frac{7}{8}\text{ (Decimally)}$   
 $\frac{7}{8} = .875$   
 $\frac{7}{8}\text{ qts.} = 1\text{ gallon.}$   
 $\frac{8}{28}\text{ } 3\text{ quarts.}$   
 $\frac{24}{4}\text{ } 4\text{ qts.} = 1\text{ gal.}$   
 $\frac{24}{4}\text{ } 3500\text{ quarts.}$   
 $\frac{2}{2}\text{ pbs.} = 1\text{ qt.}$   
 $\frac{8}{8}\text{ } 1\text{ pint.}$   
 $\frac{8}{8}\text{ } 2\text{ pbs.} = 1\text{ qt.}$   
 $\frac{8}{8}\text{ } 1000\text{ pints.}$

**Ans.** 3 quarts, 1 pint.

**To reduce a fraction of a lower, to one of a higher denomination.** Divide as in whole numbers, as described above, according to the rules for the division of fractions.

**Example.**—Reduce  $\frac{1}{2}$  of a pint to the fraction of a peck. **Solution.**— $\frac{1}{2}\text{ pt.} = \frac{1}{2}\text{ qt.}; \frac{1}{2}\text{ qt.} = \frac{1}{8}\text{ pk.}$

**Ans.** To reduce a quantity composed of one or more denominations, to the fraction of another quantity consisting of one or more denominations, Reduce both quantities to the lowest denomination in either; the less will be the numerator, and the greater the denominator of the required fraction, which reduce to its lowest terms. **Example.**— $2\text{ ft. } 6\text{ in.}$  is what part of  $6\text{ ft. } 8\text{ in.}$ ?

**Solution.**— $2\text{ ft. } 6\text{ in.} = 30\text{ in.}; 6\text{ ft. } 8\text{ in.} = 80\text{ in.}; \frac{30}{80} = \frac{3}{8}\text{ Ans.}$  **To reduce foreign money to U.S. money.** Multiply the amount expressed in units of the foreign money by the value of one of these units expressed in U.S. money. (See *Coins* under

**Weights and Measures**). **To reduce U.S. money to foreign money.** Divide the amount expressed in U.S. money by the U.S. value of a unit of the kind of money required. See *Sterling Money*.

**REGULAR.**—Conformed to a rule. A regular polygon is one which is both equilateral and equiangular.

**REMAINDER.**—The part of the subtrahend which remains after taking away the minuend.

**REPETEND.**—The part of a decimal which is continually repeated, as 64 in the decimal number 4.646464.

**RESOLUTION.**—The operation of separating any number or quantity into its factors. See *Factor*.

**REVERSION.**—A payment not due till the occurrence of some contingent event, as the death of a person now living. See *Annuity*.

**RHOMBUS.**—A parallelogram all of the sides of which are not equal. The rhombus is but a par-



ticular form of the rhomboid, in which the sides are all equal.

**RHOMBUS.**—A parallelogram the sides of which are equal. If its angles become each equal to 90°, it becomes a square. Its diagonals bisect each other at right angles, and its area is equal to half the product of its diagonals.

**RIGHT ANGLE.**—An angle of 90°. If one straight line, AB, meet another straight line, DE, so as to make the adjacent angles, ACD, and BCD, equal, both angles are right angles, and the two lines are perpendicular to each other.

**RIGHT ANGLED.**—Containing a right angle. A right angled triangle is a triangle containing one right angle.

**ROD.**—A measure of length equal to 16½ feet, or 5½ yards. It is used chiefly in land surveying.

**ROMAN NOTATION.**—See *Notation*. **ROOD.**—A unit of surface measure

used in land surveying. It is equal to 40 perches, or ¼ acre.

**ROOT.**—The root of any number is a number which, being taken a certain number of times as a factor, will produce the given number. See *Cube Root, Square Root, and Radical*, also *Involution*.

**ROUND.**—A term applied indiscriminately to the shape of conical, cylindrical, spherical, spheroidal, and annular bodies.

**RULE.**—The prescribed mode or direction given for performing the operations necessary to obtain a certain result.

**RULE OF THREE.**—A method of solving practical questions by a ratio or proportion. It is so called because the answer is obtained by finding one term of a proportion whose other three terms are known. It is also called *Simple Proportion*. **Double Rule of Three** is the same as *Compound Proportion*. See *Proportion*.

**SALIENT.**—Projecting outward as an angle. Opposed to re-entrant.

**SCALE.**—The various 'radices' which determine the form and digits of the number expressing any numerical quantity. The decimal scale is the only uniform scale that is of importance, all others possessing interest only as matters of curiosity. In varying scales, the base is some unit of measure arbitrarily assumed, as in compound numbers.

**SCALES (Balances).**—To find the true weight with fraudulent balances, when the weights are accurate, Find what weights will balance the substance to be weighed; then transpose them, and find the weight that will produce an equilibrium; then multiply together the two weights thus found, and extract the square root of the product.

**SCALENE TRIANGLE.**—A triangle whose sides are all unequal.

**SECANT.**—A straight line cutting a curve in two or more points.

**SCREW.**—A cylinder worked by a lever, and having upon its thread, which is a winding inclined plane. To estimate the advantage of a screw, Multiply the power by the circumference of the circle which it describes, and divide the product by the distance the weight is raised by one revolution.

**SECOND.**—A unit of measure employed in estimating time, and is equivalent to the 60th part of a minute. It is also a unit in circular measure, equivalent to the 3600 part of a degree.

**SECTION.**—A tract of land one mile square, containing 640 acres. See *Land Measure* under *Weights and Measures*.

**SECTOR.**—The part of a circle included between two radii and an arc. To find the area of a sector,

**MULTIPLY** the arc of the sector by half of the radius.

**SEGMENT.**—The part of a circle included between a chord and the arc which it subtends. (See *Circle*). To find the area of a segment, From the area of a corresponding sector, subtract the area of the triangle formed by the chord and radii, for a segment less than a semicircle, but add these areas for a segment greater than a semicircle.

**SERIES.**—An infinite number of terms which follow one another, each term being derived from one or more of the preceding ones, by a fixed law, called the law of the series. (See *Progression*).

**SEXTANT.**—The sixth part or the circumference of a circle.

**SEXTUPLE.**—Six times as much, or six fold.

**SHILLING.**—An English coin equivalent to about  $\frac{24}{100}$  cents.

**SHINGLES.**—When exposed four inches, 9 are required for each square foot of surface; if exposed four and a half inches, 8; if exposed five inches, 7  $\frac{1}{2}$ .

**SIGN.**—A symbol employed to indicate the relation between quantities, the operation to be performed upon them, to show the result or nature of some previous operation, or to indicate the sense in which an indicated quantity is to be considered. (See *Symbol*).

**SIGNIFICANT.**—A term applied to figures standing for numbers, as opposed to 0.

**SIMILAR.**—A term applied to figures composed of the same number of parts, which are arranged in the same manner, being of the same form, but differing in magnitude.

**SIMPLE.**—Not combined, complicated, or compounded. A *Simple Number* is a number expressed in a uniform scale. A *Simple Quantity* is one containing only a single term. A *Simple Equation* is one of the first degree. For *Simple Proportion*, see *Proportion*.

**SOLID.**—A magnitude having the attributes of length, breadth and thickness. Same as *volume*.

**SOLIDITY.**—The number of times that a solid or volume contains another solid or volume, taken as a unit of measure.

**SOLUTION.**—The operation of finding such value or values for the unknown parts of a problem, as will satisfy its conditions.

**SOUND, VELOCITY OF.**—The velocity of sound in still air at 32° Fahr., is 1090 feet per second. As the temperature rises, the velocity increases at the rate of 1.12 feet for every degree Fahrenheit. The following table gives the velocity in feet per second in some other substances:  
Oxygen . . . 1040 Silver . . . 5717  
Hydrogen . . . 4164 Steel and Glass. 16500  
Fresh Water . . . 4700 Pine . . . 10980  
Lead . . . 4090 Ash . . . 15314

**SOUNDING.**—A measured depth of water, ascertained by means of a line and lead.

**SPACE.**—Extension to an indefinite distance in all directions. It is co-extensive with, and inseparable from, the sensible, external, or Object World.

**SPHERE.**—A solid bounded by a curved surface, every point of which is equally distant from a point within called the *centre*. A line passing through the centre, and terminated each way by the surface, is called the *diameter* or *axis*. The radius is a line extending from the centre to the surface. To find the surface of a sphere, Multiply the diameter by the circumference. Or Multiply the square of the diameter by 3.1416. To find the solidity of a sphere, Multiply the cube of the diameter by 3.1416, and take one-sixth of the product, Or Multiply the area of the surface by one-sixth of the diameter.

**SPHERICAL.**—Relating to a sphere, as a spherical angle, etc.



**SPHEROID.**—A solid resembling a sphere in form, having a major and a minor axis, and which may be generated by revolving an ellipse about one of its axes. An *oblate spheroid* is one generated by revolving an ellipse about its conjugate axis. A *prolate spheroid* is one generated by revolving an ellipse about its transverse axis. To find the solidity of an oblate spheroid, Multiply the square of the greater diameter, by the less, and this product by .5236. To find the solidity of a prolate spheroid, Multiply the square of the less diameter, by the greater, and this product by .5236.

**SPHEROIDAL.**—Relating to a spheroid, as a spheroidal triangle.

**SPIRAL.**—A curve generated by moving a point along a straight line, in the same direction, according to any law, while the straight line revolves uniformly about a fixed point, always continuing in the same plane.

**SQUARE.**—A quadrilateral whose sides are equal, and its angles

right angles. The area of a square is equal to the product of two adjacent sides.

**SQUARE ROOT.**—The square root of a quantity, is a quantity which, being taken twice as a factor, will produce the given quantity. Thus, the square root of 49 is 7. The following table contains the square roots of numbers from 1 to 332:

No.	Square Root.	No.	Square Root.	No.	Square Root.	No.	Square Root.
1	1.000	58	7.681	117	10.816	175	13.228
2	1.414	60	7.745	118	10.862	176	13.266
3	1.732	61	7.810	119	10.908	177	13.304
4	2.000	62	7.874	120	10.954	178	13.341
5	2.236	63	7.937	121	11.000	179	13.379
6	2.449	64	8.000	122	11.045	180	13.416
7	2.645	65	8.062	123	11.090	181	13.453
8	2.828	66	8.124	124	11.135	182	13.490
9	3.000	67	8.185	125	11.180	183	13.527
10	3.162	68	8.246	126	11.224	184	13.564
11	3.316	69	8.306	127	11.269	185	13.601
12	3.464	70	8.366	128	11.313	186	13.638
13	3.605	71	8.426	129	11.357	187	13.674
14	3.741	72	8.485	130	11.401	188	13.711
15	3.872	73	8.544	131	11.445	189	13.747
16	4.000	74	8.602	132	11.489	190	13.784
17	4.123	75	8.660	133	11.532	191	13.820
18	4.242	76	8.717	134	11.575	192	13.856
19	4.358	77	8.775	135	11.618	193	13.892
20	4.472	78	8.832	136	11.661	194	13.928
21	4.582	79	8.888	137	11.704	195	13.964
22	4.690	80	8.944	138	11.747	196	14.000
23	4.795	81	9.000	139	11.789	197	14.035
24	4.898	82	9.055	140	11.832	198	14.071
25	5.000	83	9.110	141	11.874	199	14.106
26	5.099	84	9.165	142	11.916	200	14.142
27	5.196	85	9.219	143	11.958	201	14.177
28	5.291	86	9.273	144	12.000	202	14.212
29	5.385	87	9.327	145	12.041	203	14.247
30	5.472	88	9.380	146	12.083	204	14.282
31	5.567	89	9.434	147	12.124	205	14.317
32	5.656	90	9.486	148	12.165	206	14.352
33	5.744	91	9.539	149	12.206	207	14.387
34	5.830	92	9.591	150	12.247	208	14.422
35	5.916	93	9.643	151	12.288	209	14.456
36	6.000	94	9.695	152	12.328	210	14.491
37	6.082	95	9.746	153	12.369	211	14.525
38	6.164	96	9.798	154	12.409	212	14.560
39	6.244	97	9.848	155	12.449	213	14.594
40	6.324	98	9.899	156	12.489	214	14.628
41	6.403	99	9.949	157	12.529	215	14.662
42	6.480	100	10.000	158	12.569	216	14.696
43	6.557	101	10.049	159	12.609	217	14.731
44	6.632	102	10.099	160	12.649	218	14.764
45	6.708	103	10.148	161	12.688	219	14.798
46	6.782	104	10.198	162	12.728	220	14.832
47	6.855	105	10.246	163	12.767	221	14.866
48	6.928	106	10.295	164	12.806	222	14.899
49	7.000	107	10.344	165	12.845	223	14.933
50	7.071	108	10.392	166	12.884	224	14.966
51	7.141	109	10.440	167	12.922	225	15.000
52	7.211	110	10.488	168	12.961	226	15.033
53	7.280	111	10.535	169	13.000	227	15.066
54	7.348	112	10.583	170	13.038	228	15.099
55	7.416	113	10.630	171	13.076	229	15.132
56	7.483	114	10.677	172	13.114	230	15.165
57	7.549	115	10.723	173	13.152	231	15.198
58	7.615	116	10.770	174	13.190	232	15.232

To find the square root of a number, I. Separate the given number into periods of two figures each, beginning at the place of units. II. Find the greatest square in the left-hand period, and place



its root for the first figure of the required root. Subtract the square of this figure from the left-hand period, and to the remainder annex the next period for a dividend. **III.** Double the root already found, for a trial divisor, find how often it is contained in the dividend, exclusive of the right-hand figure, and place the result in the root, and also at the right of the trial divisor. **IV.** Multiply the complete divisor by the last figure of the root; subtract the product from the dividend, and to the remainder annex the next period for a new dividend. **V.** Proceed in the same manner with all the periods to the last. The result will be the square root required.

**STERLING MONEY.**—The currency of Great Britain. For rule to reduce to U.S. money, see *Foreign Exchange*. For table, see *English Money*, under Weights and Measures.

**STRAIGHT LINE.**—A line which does not change its direction between any two of its points.

**SUBTRACTION.**—The operation of finding the difference between two numbers. The Minuend is the greater number; the Subtrahend, the less; and the Remainder, the difference. To prove the accuracy of the operation, **I.** Add the true remainder in the subtrahend, and the sum will equal the minuend. **II.** Find the excess of 9's in the Minuend, 871386411, in the subtrahend 22356818, and in the Remainder 843023612 remainder, and take their sum, from which cast out the 9's, and find the excess. Find the excess of 9's in the minuend, and if these results are equal, the work is probably correct.

**SUBTRAHEND.**—See above.

**SUM.**—The aggregate of two or more quantities. The sum is greater than any of its parts.

**SUPERFICIAL.**—Relating to a surface, as superficial contents, etc.

**SURFACE.**—Extension in area only. A plane surface extends in the same direction throughout, but a curved surface changes its direction.

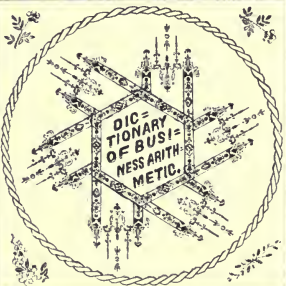
**SYMBOL.**—Any character used to represent a quantity, an operation, a relation, or an abbreviation. The sign +, called plus, indicates addition. The sign -, called minus, indicates subtraction. The sign x, indicates multiplication. The sign ÷, or /, indicates division. The sign =, called sign of equality, denotes that the expressions between which it is placed are equal. The signs { }, [ ], and a horizontal line over a number

are symbols of aggregation, and signify that the expressions enclosed are to be taken as a whole. The colon, :, written between numbers indicates the ratio of the former to the latter. (See *Ratio*). The double colon, ::, indicates the equality of two ratios. (See *Proportion*). For the sign √, see *Radical*. The period, ., placed between two numbers, thus, 4.5, denotes that they are to be multiplied together. The dividend written over the divisor, thus,  $\frac{18}{3}$ , or between two curved lines, with the divisor at the left, thus,  $4 \overline{) 16}$ , indicates division.

**TABLE.**—A collection of particulars, in a small space, for reference and ready application, such as weights, measures, etc.

**TANGENT.**—A right line which touches a curve but does not cut it, as AB is tangent to the curve CBD.

**TETRAGON.**—A polygon having four angles and four sides.



**TAXES.**—Sums of money assessed on persons, property, incomes, or products, usually for some public purpose. A *Capitation* or *Poll Tax*, is a tax assessed on persons. *Property Tax* is a tax assessed on real or personal property. To find what sum must be assessed to raise a given net amount, Subtract the rate allowed for collection from \$1, and divide the net amount to be raised, by the remainder; the quotient will be the entire sum to be assessed. **Example.**—Allowing 5% for collection, what sum must be assessed to raise \$350,000, net? *Solution.*—\$1.00 — .05 = .95; \$350,000 ÷ .95 = \$368,421.05 *Ans.* If there be a specific tax for any purpose, it must be deducted from the total amount to be raised. Then, To find how much must be paid on each dollar of taxable property to raise the remainder of the tax, Divide the amount to be raised by the amount of taxable property, less that part on which nothing can be collected. **Example.**—The property of a

certain town is valued at \$2500,000; its tax assessment is \$375,000. What rate per cent. is the tax? How much will he pay by a man whose property is valued at \$12,000? — *Solution.*— $37500 \div 2500000 = .015$ , or, 1½ cts. tax per dollar = *Ans.* In first,  $12000 \times 1\frac{1}{2} \% = \$180$  *Ans.* to second.

**Tax Table.—Rate, 14 Mills on \$1.**

Pay \$	14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308	322	336	350	364	378	392	406	420	434	448	462	476	490	504	518	532	546	560	574	588	602	616	630	644	658	672	686	700	714	728	742	756	770	784	798	812	826	840	854	868	882	896	910	924	938	952	966	980	994	1008	1022	1036	1050	1064	1078	1092	1106	1120	1134	1148	1162	1176	1190	1204	1218	1232	1246	1260	1274	1288	1302	1316	1330	1344	1358	1372	1386	1400	1414	1428	1442	1456	1470	1484	1498	1512	1526	1540	1554	1568	1582	1596	1610	1624	1638	1652	1666	1680	1694	1708	1722	1736	1750	1764	1778	1792	1806	1820	1834	1848	1862	1876	1890	1904	1918	1932	1946	1960	1974	1988	2002	2016	2030	2044	2058	2072	2086	2100	2114	2128	2142	2156	2170	2184	2198	2212	2226	2240	2254	2268	2282	2296	2310	2324	2338	2352	2366	2380	2394	2408	2422	2436	2450	2464	2478	2492	2506	2520	2534	2548	2562	2576	2590	2604	2618	2632	2646	2660	2674	2688	2702	2716	2730	2744	2758	2772	2786	2800	2814	2828	2842	2856	2870	2884	2898	2912	2926	2940	2954	2968	2982	2996	3010	3024	3038	3052	3066	3080	3094	3108	3122	3136	3150	3164	3178	3192	3206	3220	3234	3248	3262	3276	3290	3304	3318	3332	3346	3360	3374	3388	3402	3416	3430	3444	3458	3472	3486	3500	3514	3528	3542	3556	3570	3584	3598	3612	3626	3640	3654	3668	3682	3696	3710	3724	3738	3752	3766	3780	3794	3808	3822	3836	3850	3864	3878	3892	3906	3920	3934	3948	3962	3976	3990	4004	4018	4032	4046	4060	4074	4088	4102	4116	4130	4144	4158	4172	4186	4200	4214	4228	4242	4256	4270	4284	4298	4312	4326	4340	4354	4368	4382	4396	4410	4424	4438	4452	4466	4480	4494	4508	4522	4536	4550	4564	4578	4592	4606	4620	4634	4648	4662	4676	4690	4704	4718	4732	4746	4760	4774	4788	4802	4816	4830	4844	4858	4872	4886	4900	4914	4928	4942	4956	4970	4984	4998	5012	5026	5040	5054	5068	5082	5096	5110	5124	5138	5152	5166	5180	5194	5208	5222	5236	5250	5264	5278	5292	5306	5320	5334	5348	5362	5376	5390	5404	5418	5432	5446	5460	5474	5488	5502	5516	5530	5544	5558	5572	5586	5600	5614	5628	5642	5656	5670	5684	5698	5712	5726	5740	5754	5768	5782	5796	5810	5824	5838	5852	5866	5880	5894	5908	5922	5936	5950	5964	5978	5992	6006	6020	6034	6048	6062	6076	6090	6104	6118	6132	6146	6160	6174	6188	6202	6216	6230	6244	6258	6272	6286	6300	6314	6328	6342	6356	6370	6384	6398	6412	6426	6440	6454	6468	6482	6496	6510	6524	6538	6552	6566	6580	6594	6608	6622	6636	6650	6664	6678	6692	6706	6720	6734	6748	6762	6776	6790	6804	6818	6832	6846	6860	6874	6888	6902	6916	6930	6944	6958	6972	6986	7000	7014	7028	7042	7056	7070	7084	7098	7112	7126	7140	7154	7168	7182	7196	7210	7224	7238	7252	7266	7280	7294	7308	7322	7336	7350	7364	7378	7392	7406	7420	7434	7448	7462	7476	7490	7504	7518	7532	7546	7560	7574	7588	7602	7616	7630	7644	7658	7672	7686	7700	7714	7728	7742	7756	7770	7784	7798	7812	7826	7840	7854	7868	7882	7896	7910	7924	7938	7952	7966	7980	7994	8008	8022	8036	8050	8064	8078	8092	8106	8120	8134	8148	8162	8176	8190	8204	8218	8232	8246	8260	8274	8288	8302	8316	8330	8344	8358	8372	8386	8400	8414	8428	8442	8456	8470	8484	8498	8512	8526	8540	8554	8568	8582	8596	8610	8624	8638	8652	8666	8680	8694	8708	8722	8736	8750	8764	8778	8792	8806	8820	8834	8848	8862	8876	8890	8904	8918	8932	8946	8960	8974	8988	9002	9016	9030	9044	9058	9072	9086	9100	9114	9128	9142	9156	9170	9184	9198	9212	9226	9240	9254	9268	9282	9296	9310	9324	9338	9352	9366	9380	9394	9408	9422	9436	9450	9464	9478	9492	9506	9520	9534	9548	9562	9576	9590	9604	9618	9632	9646	9660	9674	9688	9702	9716	9730	9744	9758	9772	9786	9800	9814	9828	9842	9856	9870	9884	9898	9912	9926	9940	9954	9968	9982	9996	10000
--------	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	-------

**THICKNESS.**—One of the dimensions of a solid, usually the lesser one.

**TIME MEASURE.**—Used to compute the passage of time. For table, see under Weights and Measures.

**TOTAL.**—The whole sum, amount, or aggregate of several particulars.

**TRAPEZIUM.**—A quadrilateral having no two sides parallel. To find the area of a trapezium, or other irregular polygon, Divide the figure into triangles by diagonals connecting some one angular point with each of the others; then compute the area of each triangle, and find their sum.

**TRAPEZOID.**—A quadrilateral having only two of its sides parallel. To find the area of a trapezoid, or any other quadrilateral having two sides parallel, Multiply half the sum of the two parallel sides by the altitude, or perpendicular distance between the two parallel sides.

**TRIANGLE.**—A polygon having three sides and three angles. No. 1 is an isosceles triangle, and has two sides equal. No. 2 is a right angled triangle, and has one right angle. No. 3 is an obtuse angled triangle, and has one obtuse angle. No. 4 is an equilateral triangle, and has all its sides equal. No. 5 is a scalene triangle, and has no two sides equal. No. 6 is an acute angled triangle, and has all its angles acute. To find the area of a triangle, **I.** Multiply the base by half the altitude; or, **II.** From half the sum of the three sides subtract each side separately; then multiply together the half sum and the three remainders, and extract the square root of the product; the square root will be the required area.

**TRIANGLED**, or **Triangular**.—Having three angles.

**TRIGON**.—A polygon having three sides. Same as triangle.

**TROY WEIGHT**.—Used for weighing precious metals, gems, etc. For table, see under **Weights and Measures**. The Troy pound is the standard of all other weights; it is the weight of 22.7944 cu. in. of pure water at its greatest density (39.2° Fahr.). The grains mentioned in Avoirdupois Weight are Troy grains.

**TRUE DISCOUNT**.—See **Discount**.

**TRUNCATED CONE**, or **Pyramid**.—That portion of a cone or pyramid included between the base and a plane oblique to the base passed between it and the vertex. See **Cone**.

**UNDECAGON**.—A polygon having eleven sides or angles.

**UNEVEN NUMBER**.—A number not exactly divisible by 2, as 1, 3, 5, 7, etc. Same as odd number. An unevenly uneven number is one which, being divided by 4, leaves a remainder of 1, as 1, 5, 9, 13, etc.

**UNIT**.—A single thing of any kind regarded as a whole. An abstract unit is the same as 1. A unit of currency is a monetary unit, as \$1, 1 dime, 1 cent, etc. A denominator or concrete unit is one in which the kind of thing is named, as 1 foot, 1 hour, 1 pound, etc. A duodecimal unit is one in the scale of 12's. A fractional unit is one of a fraction, as  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{100}$ , etc. An integral unit is the unit 1, the unit of whole numbers. A unit of measure is a quantity of the same kind, with which the quantity is compared, as 1 inch, 1 yard, 1 foot, etc. The following is the

#### Unit System.

	Class.	Species.	Kind
UNIT OF	Things	(Immaterial	(Minds....Names.
			(Thoughts) Sentences.
		(Material	(Animals) Common names.
		(Vegetables	
		(Minerals	
	Extent	(Distance....	Ft., yds., etc.
		(Area....	Sq. in., etc.
		(Volume....	Cu. in., etc.
	Quantity	(Duration....	Time....Days, etc.
		(Weight....	Gravity....Grains, etc.
(Value....		Currency....Dollars, etc.	
Number	(Intensity....	Forces....Degrees, etc.	
	(Concrete	(Things....Words	
		(Quantity)	
	(Integral and Fractional)	Letters	
	(Abstract....	Ones or Figures	

**UNITY**.—An entire collection regarded as a single thing. Thus, 100 yards, considered as a single distance, is unity.

**VALUE**.—That which has procuring, or purchasing power, or possesses exchangeability. The numerical value of an expression is the result obtained by making each

quantity entering the expression equal to some number, and then performing the operations indicated.

**VELOCITY**.—See **Falling Bodies**, also **Table of Velocities** elsewhere in this book.

**VERIFICATION**.—The act of testing or proving computations, operations, etc., to be correct. See the tests given in connection with the different operations, as **Addition**, **Subtraction**, etc.

**VERTEX**.—A point at which the sides of an angle meet. Thus A is the vertex of the angle CAB.

**VERTICAL**.—Perpendicular to the plane of the horizon. A vertical angle is an angle, the plane of whose sides is vertical. A vertical line is the direction assumed by a plumb-line, with a weight attached to one extremity, when it is freely suspended from the other extremity.

**VOLUME**.—Dimensions; space occupied; the number of cubic



units contained in a body. See **Solidity**.

**VULGAR**.—Common. A vulgar fraction is one whose denominator does not conform to the scale of tens, in contradistinction to decimal fraction.

**WARPED SURFACE**.—A surface conforming to that generated by a straight line moving so that no two of its consecutive positions shall be in the same plane.

**WEDGE**.—A solid bounded by five plane figures, and represents two inclined planes. The advantage gained by its use may be approximately reached by the rule given for the inclined plane. The parallelogram, ABGH, is called the back. The two trapezoids, DCGH and ABCD, are called faces. The two triangles ADG and BCH, are called ends of the wedge, and CD is the edge.

**WEIGHT**.—The resultant of the forces exerted by gravity upon all the different particles of a body.

The standard unit of weight is the pound. (See **Troy Weight**). The standard Avoirdupois pound of the United States, as determined by Mr. Hassler, is the weight of 27.7015 cubic inches of distilled water, weighed in air at the temperature of maximum density (39.2° Fahr.), the barometer being 30 inches. For net and gross weight, see under **Business Terms and For ms**. For the various tables relating to weights and measures, see **Weights and Measures** elsewhere in this book. The French system of weights is one of the most perfect, as well as the most simple, of all systems that have ever been adopted. See **Metric System** under **Weights and Measures**.

**WELL**, or **Cistern**.—To ascertain the capacity of a well or cistern, Multiply the square of the diameter in inches by .7854, and this product by the depth in inches; divide this product by 231, and the quotient will be the contents in gallons. If the actual quantity of water be required, multiply by the depth of the water, and not by that of the well or cistern. See **Cistern**.

**WHEEL AND AXLE**.—A kind of lever, in which the radius of the wheel and the radius of the axle are parts of the lever, and the center of the axle is the fulcrum. To find the weight which can be raised by the wheel and axle, Multiply the power by the radius of the wheel, and divide the product by the radius of the axle or axle.

**WIDTH**, or **Breadth**.—One of the three attributes of extension, the other two being length and height or thickness. Width is usually applied to the intermediate dimension of a body, length to the greatest, and thickness to the least.

**WINE MEASURE**.—Used in measuring nearly all liquids, such as liquors, molasses, water, etc. For table, see under **Weights and Measures**.

**YARD**.—A measure of length equal to 3 feet, or 36 inches. In **Cloth Measure**, the yard is now divided into binary parts, the old division into quaternary parts of quarters and nails (na. =  $\frac{1}{4}$  in.) being now seldom used.

**YEAR**.—A unit of time, determined by the revolution of the earth in its orbit. The year is either astronomical or civil. The length of the solar year is 365 days, 5 hours, 48 minutes, and 49.7 seconds. The civil year is the year of the calendar.

**ZENITH**.—The point in the heavens in a line with the spectator's position and the center of the earth. The nadir is the point directly under the spectator's feet.

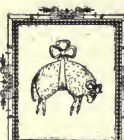
**ZERO**.—The character 0, which signifies no number. See **Cipher**.

**ZONE**.—The area of a zone is equal to the circumference of the circle of the sphere, multiplied by the zone's altitude.





## STANDARD WEIGHTS &amp; MEASURES.



**AREA.** Dimensions of.—See Land Measure.

**ALCOHOL.** Percentages in wine and liquors.—Aik, 7.4; Aniseed, 33.0; Beer, 4.0; Bordeaux, 11.5; Brandy, 53.4; Butyrine, 13.6; Canary, 18.8; Cassia, 19.2; Chateau, 43.0; Cider, 8.6; Champagne, 12.2; Claret, 13.3; Cutacao, 27.0; Elder, 9.3; Gooseberry, 11.8; Hock, 11.6; Lisbon, 18.5; Moselle, 9.6; Malaga, 17.4; Malmsey, 19.7; Marsala, 20.2; Madeira, 21.0; Mataschino, 34.0; Orange, 11.2; Port, 4.5; Port, 23.2; Perry, 8.8; Rhine, 11.0; Sherry, 19.0; Scotch, 54.3; Tokay, 11.2; Vermont, 19.0; Whiskey (Canadian), 53.9; Whiskey (Irish), 53.9; Whiskey (Scotch), 54.3. (Spirits are said to have "proof" when they contain 51 per cent.)

**APOTHECARIES' WEIGHT.**—20 Grains (gr) = 1 Scruple; 3 Scruples (℥) = 1 Dram; 8 Drams (℥) = 1 Ounce; 12 Ounces (℔) = 1 Pound (lb.). Also, 60 Minims (m) = 1 Fluidram; 8 Fluidrams (℥) = 1 Fluidounce; 16 Fluidounces (℔) = 1 Pint; 2 Pints (℔) = 1 Gallon (Gal.).

Also, 1 Common teaspoonful = 45 drops; 1 com. teaspoonful = 4 com. tablespoonful = 1 Fluidram; 1 com. tablespoonful = 4 com. teaspoonful = about 4 Fluidrams; 1 com. teaspoonful = about 4 Fluidrams; 1 Pint of water = about 1 pound.

**APOTHECARIES' WEIGHT.**—1 Carat = 10 Pwt. Troy; 1 Carat grain = 2 pwt. 12 gr. or 60 gr. Troy; 24 Carats = 1 Pound Troy. (See Volume of Air.)

**ATMOSPHERIC WEIGHT.**—In whole numbers the atmospheric pressure per square inch is 15 pounds. **MERCURY.**—A column, 1 inch square, and 30 inches high = 14.73 pounds. **WATER.**—A column, 1 inch square, and 33.95 feet high = 14.73 pounds.

**NAVIGATORS' WEIGHT.**—16 Ounces = 1 Ounce; 16 Ounces = 1 Pound; 25 Pounds = 1 Quarter; 4 Quarters = 1 Cwt.; 20 Cwt. = 1 Ton.

In the English or Long Ton, 112 pounds = 1 Cwt.

**BAROMETER.** Height at different elevations above the sea-level.—1000 ft., 29.9 inches; 2000 ft., 27.86 in.; 3000 ft., 26.85 in.; 4000 ft., 25.87 in.; 5000 ft., 24.93 in.; 1 mile, 24.67 in.; 2 miles, 20.29 in.; 3 miles, 16.08 in.; 4 miles, 13.72 in.; 5 miles, 11.28 in.; 10 miles, 4.24 in.; 15 miles, 1.60 inches.

**BARRELS, CASKS, ETC.**—25 Pounds = 1 keg of powder; 56 lbs. = 1 Firkin of butter; 100 lbs. = 1 Cistral of grain; 100 lbs. = 1 Cask of raisins; 100 lbs. = 1 Quintal of dried fish; 196 lbs. = 1 bbl. of flour; 200 lbs. = 1 bbl. of beef, pork, or fish; 256 lbs. = 1 bbl. of soap; 280 lbs. = 1 bbl. of salt.

**BOMB MEASURE.**—See Lumber Measure on another page.

**BOOKS.** Measurements or Sizes of.—The principal sizes of books are four, namely: Folio, a long book; Quarto (4to), neatly square (is similar to this Manual); Octavo (8vo), the general size; and Duodecimo (12mo), a small book. Other smaller forms are: Sixteen mo (16mo), twenty-four mo (24mo), Thirty-two mo (32mo), and Forty-eight mo (48mo).

**FOLIO.**—The standard size of book paper is 25 x 38 inches; one half of the sheet being 19 x 25 inches, which folded in two

leaves, with four pages, makes a book of the size called a folio. **QUARTO.**—When the half sheet is folded in four leaves, with eight pages, it forms a quarto size. **OCTAVO.**—When the half sheet is folded in eight leaves, with sixteen pages, it forms an octavo; and so on for duodecimo, 16mo, 18mo, 24mo, etc.

**SIGNATURE.**—The marks a, b, c, 1, 2, 3, etc., occasionally found at the bottom of the page, are for the direction of the binders in folding the sheets.

**NAME OF PAPER AND ITS DIVISION FOR BOOKS.**—SIZE OF TYPE MOST SUITABLE, AND THE NUMBER OF WORDS AVERAGE IN EACH SIZE OF TYPE.

NAME OF PAPER AND ITS DIVISION FOR BOOKS	SIZE OF TYPE MOST SUITABLE, AND THE NUMBER OF WORDS AVERAGE IN EACH SIZE OF TYPE
FOLIO (4to)	61 x 8 1/2
Quarto (4to)	41 x 6 1/2
Octavo (8vo)	34 x 5 1/2
Duodecimo (12mo)	31 x 4 1/2
Sixteen mo (16mo)	28 x 4 1/2
Octavo (8vo)	7 1/2 x 10
Octavo (8vo)	5 7/8 x 7 1/2
Duodecimo (12mo)	3 1/2 x 6 1/2
Sixteen mo (16mo)	3 1/8 x 5 1/2
Octavo (8vo)	8 1/2 x 11 1/2
Quarto (4to)	5 1/2 x 8 1/2
Octavo (8vo)	4 1/2 x 7 1/2
Duodecimo (12mo)	4 1/8 x 6 1/2
Sixteen mo (16mo)	3 1/2 x 5 1/2
Thirty-two mo (32mo)	2 1/2 x 4 1/2
Quarto (4to)	10 x 12 1/2
Octavo (8vo)	5 1/2 x 8 1/2
Duodecimo (12mo)	5 x 8 1/2
Sixteen mo (16mo)	5 x 6 1/2
Thirty-two mo (32mo)	3 1/2 x 5 1/2

\* EXCLUSIVE OF HEADLINE. \* SIZES OF PAPER UNDER PAPER NAME. \* PL. Pica; S. Small Pica; L. P. Long Primer; B. Bourgeois; Brev. Brevier; Min. Minion; Non-Paralel. Sex. Size of type, sex number type.

The following measurements may be useful as giving an idea of the sizes of books as fixed by the librarians who have abolished the time-honored expressions, "imperial," "crown," "foolscap," "demij," etc., and adopted the almost equally vague terms "large" and "small" instead: **LARGE** folio (la. fol.), over 18 inches; **FOLIO** below 18 inches; **SMALL** folio (sm. fol.), below 13 inches; **LARGE** octavo (la. 8vo), below 11 inches; **OCTAVO** (8vo), below 9 inches; **SMALL** octavo (sm. 8vo), below 8 inches; **DUODECIMO** (12mo), below 8 inches; **DECEMO** octavo (10mo), below 6 inches; **MINIMO** (7mo), below 6 inches; **LARGE** quarto (la. 4to), below 15 inches; **QUARTO** (4to), below 11 inches; **SMALL** quarto (sm. 4to), below 8 inches.

Modern manuals are prepared to give exact ton, pwt., or oz. size whatever. This Manual is printed on a half size.

**BOX MEASURES.**—A box 16 by 16 inches square, and 8 inches deep, contains a bushel, or 2150.4 cubic inches, and each inch in depth containing one gallon.

A box 24 by 11 1/2 inches square, and 8 inches deep, will also contain a bushel. If 12 by 11 1/2 inches square, and 8 inches deep, it will contain half a bushel. If 8 by 8 1/4 square an 8 deep, it contains half a peck. If 4 by 4 1/4 square, and 4 1/2 deep, it contains one quart.

**BRICK SIZE AND WEIGHT OF.**—See Man and Machine.

**BRICK MEASUREMENT.**—To find the number of bricks required for any building, multiply the dimensions, length, height, and thickness, in feet and fractions of a foot, of the several brick walls, and the product by 2 1/2, a third the result will be the number of bricks required. Allowance must be made for doors, windows, chimneys, etc.

The subjoined table is reckoned on a basis of 7 bricks to the superficial square foot. For 17 superficial feet, add the numbers for 10 and 7; for 75, add 70 and 5; for 500 superficial feet, take 5 times 100; etc.

SUPERFICIAL FEET	NUMBER OF BRICKS TO THICKNESS OF	4 IN.	6 IN.	8 IN.	10 IN.	12 IN.	16 IN.	20 IN.	24 IN.
1	1	7	15	23	30	38	45	52	60
2	2	15	30	45	60	75	90	105	120
3	3	23	45	68	90	113	135	158	180
4	4	30	60	90	120	150	180	210	240
5	5	38	75	113	150	188	225	263	300
6	6	45	90	135	180	225	270	315	360
7	7	52	105	158	210	263	315	368	420
8	8	60	120	180	240	300	360	420	480
9	9	68	135	207	270	338	405	473	540
10	10	75	150	225	300	375	450	525	600
20	20	150	300	450	600	750	900	1050	1200
30	30	225	450	675	900	1125	1350	1575	1800
40	40	300	600	900	1200	1500	1800	2100	2400
50	50	375	750	1125	1500	1875	2250	2625	3000
60	60	450	900	1350	1800	2250	2700	3150	3600
70	70	525	1050	1575	2100	2625	3150	3675	4200
80	80	600	1200	1800	2400	3000	3600	4200	4800
90	90	675	1350	2025	2700	3375	4050	4725	5400
100	100	750	1500	2250	3000	3750	4500	5250	6000

**BUILDINGS.** See also Capacity of.—Colosseum at Rome, 87,000; Cathedral at Milan, 37,000; St. Peter's, Rome, 32,000; St. Paul's, London, 21,000; St. Peter's, Rome, 54,000; St. Petronio, Bologna, 24,400; Cathedral, Florence, 24,300; Cathedral, Antwerp, 24,000; St. John Lateran, Rome, 23,000; St. Sophia, Constantinople, 23,000; Notre Dame, Paris, 21,000; Theater of Marcellus, Rome, 20,000; Cathedral, Pisa, 19,000; St. Stephen's, Vienna, 12,400; St. Dominic's, Bologna, 12,000; St. Peter's, Bologna, 11,400; Cathedral, Vienna, 11,000; Gilmore's Garden, New York, 8,443; Mortuary Temple, Salt Lake, 8,000; St. Mark's, Venice, 7,500; Spurgottes Tabernacle, London, 6,000; Bolsoin Theater, St. Petersburg, 5,000; Music Hall, Cincinnati, 4,824; Chicago Auditorium, 8,000; Academy of Music, Philadelphia, 2,865.

**BUILDINGS.** Height of.—See Monuments and Towers.

**BUSHEL.** Number pounds in.—Barley, 48 (30 Cal., 47.9, Ky., Pa.); Beans, 60 (64 Me.); Bran, 20; Buckwheat, 52 (40, Cal., 48, Conn., Me., Mass., Mich., N.J., N.Y., Tenn., Va.); Corn, 56 (50, N.J., N.Y., Pa., S.C.); Castor Beans, 48; Clover Seed, 60 (64, N.H., N.Y., Pa.); Coal—Anthracite, 80, (76, Ky.); Corn Cob, 70 (68 Ind.); Corn—Shelled, 56 (52, Cal., Va., 53, Ky.); Corn Meal, 50 (48, Ga., Ill., 48, N.J.); Dried Apples, 24 (25 Ind., 26, S.C., Tenn.); Dried Apples, 24 (25 Ind., 26, S.C., Tenn.); Dried Peaches, 33; Flax Seed, 56 (54, Kan., 55, N.J., N.Y., 44, R.I., Grass—Blue, 41; Grass—Red top, 14; Hair—Fleming, 8; Hemp Seed, 44; Hungarian Grass, 50; Lime—Unslaked, 30; Millet Seed, 50;

FROM BEN O'BY, MASTER OF THE ARTS.





# WEIGHTS & CONTN. MEASURES. VED.

## COMPOSITIONS. Proportions of Various.

Babbitt's Metal. . . . . Tin 89, Copper 3, Antimony 7.3.  
Church Bells. . . . . Copper 80, Zinc 56, Tin 10, Lead 4.3.  
Finest Yellow Brass. . . . . Copper 66, Zinc 34.  
German Silver. . . . . Copper 33.3, Zinc 33.4, Nickel 33.3.  
Gongs. . . . . Copper 81.6, Tin 18.4.  
Gun Metal, Vases, etc. . . . . Copper 80, Tin 10.  
Lath Bushes. . . . . Copper 80, Tin 20.  
Machinery Bearings. . . . . Copper 87.5, Tin 12.5.  
Munich Metal. . . . . Copper 60, Zinc 40.  
Sheathing Metal. . . . . Copper 56, Zinc 44.  
White Brass. . . . . Copper 10, Zinc 80, Tin 10.

## COOKS. Weights for Use of.

One lb. broken loaf sugar = 1 quart; 1 lb. and 1 oz. powdered white sugar = 1 quart; 1 lb. and 2 oz. best brown sugar = 1 quart; 1 lb. soft butter = 1 quart; 1 lb. and 2 oz. Indian meal = 1 quart; 1 lb. wheat flour = 1 quart; 4 large tablespoons = 1 gill; a common sized tumbler = 1 pint; a common sized wine-glass = 1/2 gill; a large wine-glass = 2 oz.; a teacup = 1/2 gill; a tablespoonful = 1/2 oz. (See Apothecaries' Weight).

**CORN**, in Crib or Bed, Measurement of.—See Mensuration (Index).

**CORDWOOD**, Relative Weights of.—A cord of hickory weighs about 4,500 lbs.; a cord of beech, 3,225 lbs.; hard maple, 2,850; Ash, 3,450; pitch pine, 1,900; red oak, 3,250; Lombardy poplar, 1,800.

**CREMATION**.—A body weighing 140 lbs. in burning 55 minutes will produce 3 lbs. of ashes.

**COUNTING**, Time Required for.—Assuming that a person can count at the rate of 200 per minute, for 12 hours a day, to count, 1,000,000, would require 6 days 11 hr. 20 min. 1,000,000,000, " 19 yr. 4 " 18 " 20 " 1,000,000,000,000, " 19 yr. 4 " 11 " 52 " 1,000,000,000,000,000, would require more than 19,000,000 years.

**CURRENTS IN RIVERS**, Rate of Flow necessary to carry off different substances.—River mud, liquid earth, etc. 3 inches per second; brown pottery clay, 4 in. per sec; common clay, 6 in. per sec; yellow sand, loamy, 8 in. per sec; common river sand, 1 foot per sec; gravel, size of small seeds, 5 in. per sec; gravel, size of peas, 7 in. per sec; gravel, size of beans, 1 ft. per sec; coarse ballast, 2 ft. per sec; sea shingle, about one in. in diam., 2 1/2 ft. per sec; fine shingle, 3 ft. per sec; angular flints, size of hen's eggs, 3 1/2 ft. per sec; broken stones, 4 ft. per sec; soft shistose rock, 4 1/2 ft. per sec; flaky rock, 6 ft. per sec; hard rocks, 10 ft. per sec.

## CUBIC FOOT WEIGHTS of Various Materials.

Antimony 421.61 lb. 34.3 Pm (Pichel) 41.0  
Ashwood 52.8 Goldpum 120.4 Pm Whitelet 29.6  
Beetle. . . . . 52.3 Granite. . . . . 139.0 Pm Yellow 33.8  
Brass. . . . . 537.7 Ice. . . . . 58.08 Plaster Paris 105.0  
Brick. . . . . 100.0 Iron (cast). 450.5 Quartz. 163.0  
Cedar. . . . . 37.8 Iron (wht). 486.6 Salt (com.) 132.0  
Charcoal. 18.2 Lead. 708.4 Sand. . . . . 94.5  
Clay. . . . . 120.0 Lignum Vitæ 82.3 Silver (pure) 654.9  
Coal, Anthr. 53.0 Mahogany 66.5 Spruce. . . . . 31.3  
Coal, Bitum. 50.0 Maple. . . . . 46.8 Sulphur. 172.0  
Copper. . . . . 554.5 " 141.0 Walnut. . . . . 55.0  
Cork. . . . . 15.0 Mercury (848.5) Water (fresh) 62.5  
Earth (loose) 35.0 Mill-stone 130.0 " (cast) 64.3  
Earth, loose 90.0 Oak (live) 70.0 " (dried) 62.3  
Etm. . . . . 42.0 Oak (white) 45.2 " (Red) 71.4

**CUBIC OR SOLID MEASURE**.—1728 cubic inches = 1 cubic foot; 27 cu. ft. = 1 cu. yd.; 128 cu. ft. = 1 cord; 8 cord feet = 1 cord; 16 cu. ft. = 1 cord foot; 244 cu. ft. = 1 perch of stone; 40 cu. ft. = 1 ton of ship cargo; 50 cu. ft. = 1 ton of square timber; 2150.42 cu. in. = 1 bushel; 231 cu. in. = 1 gallon (wine); 282 cu. in. = 1 gallon (ale or beer—nearly obsolete); 1 cu. ft. = 1/2 of a bushel.

## DAILY SAVINGS, at Compound Interest.

\$60.02 daily = \$10,000 yearly = \$130 in 10 years = \$2,900 in 50 years.  
\$60.05 daily = \$20 yearly = \$260 in 10 years = \$5,800 in 50 years.  
\$60.11 daily = \$40 yearly = \$520 in 10 years = \$11,600 in 50 years.  
\$60.27 daily = \$100 yearly = \$1,300 in 10 years = \$29,000 in 50 years.  
\$60.55 daily = \$200 yearly = \$2,600 in 10 years = \$58,000 in 50 years.  
\$61.10 daily = \$400 yearly = \$5,200 in 10 years = \$116,000 in 50 years.

## DAY, Length at Various Capitals.

	LONGEST DAY	SHORTEST DAY
Amsterdam. . . . .	16 hr. 44 min.	7 hr. 33 min.
Berlin. . . . .	16 " 38 "	7 " 30 "
Boston. . . . .	15 " 16 "	9 " 58 "
Calcutta. . . . .	14 " 00 "	10 " 10 "
Calcutta. . . . .	13 " 26 "	9 " 42 "
Cape Town. . . . .	14 " 22 "	9 " 54 "
Copenhagen. . . . .	17 " 20 "	7 " 18 "
Dublin. . . . .	16 " 56 "	6 " 50 "
Edinburgh. . . . .	17 " 32 "	6 " 50 "
London. . . . .	16 " 32 "	7 " 44 "
Madrid. . . . .	15 " 00 "	9 " 14 "
Naples. . . . .	15 " 03 "	9 " 14 "
Panama. . . . .	12 " 36 "	11 " 34 "
Paris. . . . .	16 " 06 "	8 " 10 "
Peking. . . . .	14 " 58 "	9 " 16 "
St. Petersburg. . . . .	18 " 14 "	5 " 42 "
Stockholm. . . . .	18 " 35 "	5 " 54 "
Sitka. . . . .	18 " 16 "	6 " 10 "
Vietnam. . . . .	15 " 58 "	8 " 17 "
Washington. . . . .	14 " 52 "	9 " 22 "

## DAY'S FOOD, Expressed in Foot Tons.—A

man of average weight, and doing a fair day's work, requires, as has been ascertained by experiment, so much food as, converted into mechanical work, would raise 4,000 tons one foot high.

## DIAMOND WEIGHT.

16 Parts = 1 Grain = .8 Grain Troy.  
4 Grains = 1 Carat = 3.2 " "  
20 Parts Diamond Wk. = 1 " "

**DIGIT**.—The twelfth part of the diameter of the Sun or Moon, used in measuring the extent of a partial eclipse.

## DISTANCE ONE CAN SEE.—The earth

being round, its convexity limits the vision even on a level like the sea. The line of vision on the sea-shore of a man of ordinary height, say six feet six inches, is intercepted by the horizon at 3.4 miles. If he were looking at a flag on a mast-head 44 ft. in height, the flag would seem to be on the horizon if it were 9.35 miles distant. In this case add the height of the object 44 ft. to the height of the eye from the ground 6 ft. = 50 ft., and find the corresponding distance in the table.

	HEIGHT OF EYE FROM GROUND IN FEET.	DISTANCE IN MILES.	HEIGHT OF OBJECT IN FEET.	DISTANCE IN MILES.	HEIGHT OF EYE FROM GROUND IN FEET.	DISTANCE IN MILES.
3	4	2.63	11	4.39	20	5.92
0	5	2.96	12	4.58	25	6.61
3	6	3.24	13	4.77	30	7.25
0	7	3.49	15	5.12	35	7.83
5	8	3.73	17	5.45	40	8.37
3	9	3.96	18	5.61	45	8.87
0	10	4.18	19	5.77	50	9.35
4					55	9.79

# WEIGHTS & MEASURES

**DURABILITY OF WOODS.**—Experiments have been made by driving sticks, made of different woods, each five feet long and one and one half inches square, into the ground, only one half inch projecting outward. After the lapse of five years, all those made of oak, elm, ash, fir, soft mahogany, and nearly every variety of pine were totally rotten; larch, hard pine and oak were decayed only on the outside; acacia was only slightly attacked on the exterior; hard mahogany and cedar of Lebanon were in tolerably good condition, and Virginia cedar was as sound as when put into the ground.

**DYNAMITE.** Force &c.—The power developed by the explosion of a ton of dynamite is equal to 45,075 foot-pounds. 71,000 tons of ordinary building stone, if arranged in the form of a cube, would make only about 30 feet to the side, and it is very possible to concentrate the entire force of a ton of blasting gelatine to point, the force from the explosion would lift the mass only one foot. (See Explosives).

**EARTH, WEIGHT OF.**—Baily contrived a pair of scales that enabled him to approximately ascertain the weight of the earth, and that it contained within itself somewhere about 6,049,836 billion tons of matter.

**EARTH, SAND, ETC., WEIGHT OF per Cubic Foot.**—See Cubic-Foot Weights, also Specific Gravity.

**EGGS, WEIGHT OF.**—See Chickens.

**ELECTRICITY, MEASURE OF.**

Quantity	Unit	How obtained.	Equivalent.
Ohm R	Resistance	The electrical resistance of a column of mercury 106 centimeters long and of 1 sq. millimetric section.	10 <sup>9</sup> true ohms 1,012 British Association ohms.
Ampere C	Current	Is that current that decomposes .000374 grammes of water per second.	10 <sup>9</sup> Deposits 1.118 milligrams of silver per second.
Volt E	Electric motive force	One ampere of current passing through a substance having ohm of resistance at 1 volt.	10 <sup>9</sup> .526 of a standard Daniell Cell.
Coulomb Q	Quantity	A current of 1 ampere in 1 sec. of time.	10 <sup>9</sup> Deposits 1.118 milligrams of silver.
Farad K	Capacity	The capacity that at 1 ampere per sec. (-) coulomb charges to 1 potential of 1 volt.	10 <sup>9</sup> 2.5 knots of 1-millionth of a farad.
Microfarad K	Capacity		
Watt Pw	Power	Power of 1 ampere current passing through resistance of 1 ohm.	10 <sup>9</sup> .0013405 (or .00136) of a horse power.
Joule Wj	Work	Work done by 1 unit of electric power per sec.	10 <sup>9</sup> .228 units of heat (Thermal).

\* Electro-Magnetic Units.—See Technical Terms.

**ENERGY.** Amount Required to do Different Things, Expressed in Foot-Tons.—(A foot-ton is the amount of energy necessary to raise one ton one foot.)—Walking 1 mile, 172; walking 4 miles, 703; carrying

60 lbs. 1 mile, 25; pedlar's day's work, 363; convict's day's work, 310; dock laborer's work, 315; pile-driving, 332; pavior, 352; turning a winch, 374; man's ordinary work, 300; very hard work, 403.

## ENGLISH MONEY.

4 Farthings (far) = 1 Penny (d) =  $\frac{1}{20}$  of a £  
12 Pence = 1 Shilling (s) =  $\frac{1}{20}$  of a £  
20 Shillings = 1 Pound (£) =  $\frac{1}{100}$  of a £

## EQUVALENTS.

Volume.	Weight.
1 gal. Wine, Mes. = 231 cu. in.	1 lb. Av. = 7000 gr. Troy.
1 gal. Beer = 282 "	1 lb. Apoth. = 3750 "
1 gal. Dry = 268.8 "	1 oz. Av. = 437.5 "
1 gal. (Eng.) = 277.2 "	1 oz. Apoth. = 480 "
1 bu. (U.S.) = 2150.42 "	1 carat, Assay = 240 "
1 bu. (Eng.) = 2118.19 "	1 carat, dial = 3.2 "
1 bu., heaped = 2747.7 "	1 cu. li. pure water = 4000 oz. Av.

**EXPANSION AND CONTRACTION.**—The following table exhibits the linear-dilatation of bodies from 32° to 212°.

Flint glass.....	7321	Brass, cast.....	574
Glass bottom, tube.....	1770	Solder, 100 lead.....	339
" solid rod.....	933	Bismuth.....	715
" cast, prism of.....	873	Spectulum metal.....	577
Platinum.....	1781	Iron.....	875
Palladium.....	7650	Steel.....	673
Gold.....	567	Tin.....	473
Silver.....	532	Lead.....	535
Copper & parts, 100.....	536	Zinc.....	548
Copper.....	536	Mercury, in volume.....	555
Copper, 2 zinc.....	486	Water.....	57
Brass 16, 100.....	574	Alcohol.....	59
Brass wire.....	577	All the gases.....	289

**EXCEPTION OF LIFE.**—See Carlsle Table.

**EXPLOSIVES.** Force of Various Kinds.—Most explosives derive their energy from nitro-glycerine. Dynamite is nitro-glycerine compounded with rosin-stone, or silicious, or insular earth, tripoli, etc. Dynamite is a compound of nitro-glycerine and saw-dust. See Explosive Powder is a mixture of plaster of Paris and nitro-glycerine. The subjoined table is by M. Berthelot. (See DYNAMITE).

Explosive.	Heat.	Volume.	Explosion.
Nitro-glycerine.....	1320	0.710 liter	939
Picric Acid.....	1422	0.337 "	478
Picric Acid, with Chl. Potash	1424	0.408 "	582
Gun Cotton.....	1420	0.484 "	680
Picric Acid.....	1420	0.585 "	680
Picric Acid.....	687	0.780 "	536
Gun Cotton.....	590	0.691 "	472
Powder, base Chl. Potash.....	973	0.318 "	309
Powder, base barite Soda.....	764	0.248 "	150
Powder, sporting.....	641	0.216 "	39
Powder, artillery.....	608	0.225 "	137
Powder, blasting.....	509	0.172 "	88

**FECUNDITY OF ANIMALS.**—The camel, elephant, and horse seldom produce more than one at a birth; the lion 1, often 2 or 3, sometimes 5 or more. The fecundity of the rabbit is marvellous, it beginning to breed at the age of six months, having from 6 to 7 litters a year, each from 4 to 12, or upwards.

A codfish has been found to produce 3,686,760 eggs or spawn, and a ling upward of 10,000,000. Herrings from 2,295 to 36,960. Mackerel, 454,061. Sea bream, 28,772; flounder, 1,357,403. Lobster, 21,699; prawn, 3,800; shrimp, 6,800.

M. Von Gleichen, a German naturalist, has made the annexed calculation for the common house fly.

A fly lays four times during the summer, each time eighty eggs..... 320  
Half of these are supposed to be females, so

that each of the four broods produce forty:

1. First eight of the forty females of the first brood, lay four times.....	12,800
The first eighth of these, or 16,000 females, lay, three times.....	384,000
The second eighth, twice.....	256,000
The third and fourth eighth, once.....	256,000
2. The second eighth, or the forty females of the second brood, lay three times.....	9,600
One sixth of these, three times.....	384,000
The second sixth, twice.....	256,000
The third sixth, once.....	128,000
3. The third eighth, or the forty females of the third brood, twice.....	6,400
One fourth of these, lay twice.....	256,000
4. The fourth eighth, or forty females of the fourth brood, once.....	3,200
Half of these lay once.....	128,000

Total for one fly in one summer, 2,080,320

**FEMINE HEIGHT AND WEIGHT.**—(See also Man and Woman Index).—It is often asked how stout a woman ought to be in proportion to her height. The following table gives a fair indication of the proper proportions:

Height.	Weight.	Weight.
Five feet..... about 100	Five ft. seven in. abt 150	
Five ft. one in. " 100	Five ft. eight in. " 155	
Five ft. two in. " 113	Five ft. nine in. " 163	
Five ft. three in. " 119	Five ft. ten in. " 169	
Five ft. four in. " 130	Five ft. eleven in. " 176	
Five ft. five in. " 138	Six ft. " 180	
Five ft. six in. " 144	Six ft. one in. 186	

**FEEDING TABLE.** Showing the Amount of Hay, or its Equivalent, per day required by each 100 pounds of live Weight of Animals.—Working horses, 30 lbs. dry cows..... 2.47 lbs. over. 2.40 " Young cattle..... 3.08 " Fatting oxen..... 5.00 " Steers..... 2.84 " " when fat, 4.00 " Pigs..... 3.00 " Milch cows..... 2.35 " Sheep..... 3.00 "

A horse will consume as much food, aside from corn, as 8 sheep; a cow, as 12 sheep; a fatting ox, as 10 sheep; a two-year-old heifer, as 6 sheep; a three-year-old heifer, as 8 sheep; a one-year-old heifer, as 4 sheep; a calf, as 2 sheep.

**FINESS OF COINS.**—See Coins.

**FLOUR.** Amount that wheat should yield. A bushel of good wheat, 60 lbs., should yield about 48 lbs. of flour, 8 lbs. of shorts, and 4 lbs. of bran. The following is a fair average, which gives 38.45 lbs. of flour to the bushel:

Weight of wheat.....	1,486 lbs.
" " flour.....	952 lbs.
" " bran.....	240 "
" " screenings.....	32 "
" " middlings.....	88 "
" " poll.....	148 "
" " waste.....	26 "
" " " " " " " " " " " "	1,486 lbs.

**FLUIDS, PRESSURE OF.**—1. Fluids submitted to pressure transmit it undiminished in every direction. 2. The pressure sustained by any surface is proportional to its area. 3. The direction of the pressure at any point is perpendicular to the surface at that point. 4. The pressure on the bottom of a vessel is independent of the form of the vessel. 5. The pressure is proportional to the density of the liquid. 6. The pressure exerted by a fluid is proportion to its depth. 7. A fluid is in equilibrium, or at rest, only when its particles are restrained by some vessel or its equivalent.





# WEIGHTS & MEASURES CONTINUED

**GASES.** Expansion of. - See Expansion and Contractions.

## GERMINATION OF SEEDS.

**Time of.** - Wheat and millet seed germinate in one day; barley, seven; cabbage, ten; peach, almond, and chestnut, require from eight to twelve months; rose and flint require twenty-four months. Potatoes buried three-feet deep do not vegetate. If wheat be covered 2 inch deep, it usually appears above the ground in 11 days; 1 inch deep, 12 days; 2 inches deep, 18 days; 6 inches deep, 23 days. A field of wheat after having been buried under an avalanche for 25 years, grew after the snow melted. (See Vitality of Seeds.)

## GESTATION.

**Periods of in Various Animals.** - The period of gestation is longer in herbivorous than in carnivorous animals. The young of the latter are also less developed at birth, their eyes not opening for several days thereafter. **Mammivorous animals.** - The elephant has about 204 months gestation; the giraffe, 14 months; mare, 12 months; ass and buffalo, 12 months; mare, upward of 11 months; rhinoceros and cow, 9 months; larger deer, over 8 months; sheep and goats, 5 months; pig, 4 months. **Reptiles.** - Beaver, 4 months; dormouse, 31 days; rabbit, 30 to 31 days; rat and squirrel, 28 days; guinea-pig, 20 to 21 days. **Carnivorous.** - Bear, 6 months; lion, 108 days; puma, 72 days; wolf, and dog, 62 to 63 days. **Pouched animals.** - Kangaroo, 39 days; opossum, 26 days. **Reptiles.** - Greenland whale, about 10 months. **Monkeys.** - The most common duration for the varieties of monkeys is 7 months. **Oviparous animals.** - The goose sits 30 days; swan, 42 days; hens, 21 days; ducks, 30 days; pea-hens and turkeys, 28 days; canaries and pigeons, 14 days; parrots, 40 days. **Owls.** - Human being, 280 days; hippopotamus, 234 days; cat, about 56 days; bat, 40 days; marmoset, 120 days; sapir, 10 to 11 months.

## GIANTS.

NAME.	PLACE.	TIME.	HEIGHT.
Og (Deut. 3, 11).....	Bashan	1451	182-161
Goliath.....	Palestine	1063	11-0
Maxim.....	Rome	235AD.	8 1/2 ft.
Gabon.....	Rome	2697B.C.	9 ft. 8 in.
John Middleton.....	England	1768A.D.	3 ft. 3 in.
Patrick Colker.....	Ireland	1761	8 ft. 7 in.
Frederick's Swede.....	Sweden	.....	8 ft. 4 in.
Gilly.....	Turkey	.....	8 ft. 1 in.
Charles Byrne.....	Ireland	1780	8 ft. 4 in.
Big Sam.....	England	1809	8 ft. 0 in.
M. Brice.....	Vosges	1863	7 ft. 6 in.
Robert Hall.....	England	1863	7 ft. 6 in.
Chang-Woo-Gow.....	China	1865	7 ft. 8 in.
Martin Van Buren	Kentucky	1871	7 ft. 0 in.
Miss Anna Swan	Nova Scotia	1871	7 ft. 0 in.

## GLASS.

**Composition of.** - Crown Glass: Purified sand, 100 parts; lime stone, or chalk, 35 to 40 parts; sulphate of soda, 40 to 45 parts; cullet, 50 to 150 parts. French Plate: White quartzose sand 100.0 parts; soda carbonate, 33.3 parts; lime (slaked), 14.3 parts; manganese peroxide, 0.15 parts; cullet, 100.0 parts. Flint Glass: Fine white sand, 100 parts;

minimum (red lead, 63 parts; refined potash, 33 parts; nitre, 10 parts; cullet, 60 to 100 parts).

The following are other proportions for optical and flint glass: Sand, 51 parts; pearl ash (greenish), 16 parts; litharge, 28 parts; red lead, 29 parts; nitre, 44 parts; white arsenic, 4 parts; peroxide of manganese, 6 parts; cullet of flint glass in proportion as the manufacturer thinks proper.

**Bottle Glass.** - This is the coarsest glass in common use, and is made from varied proportions of the following: Soap-makers' waste (containing a quantity of soda-salts), fresh water, river sand, brick-dust, calcined lime, and merl.

**Colored Glass.** - The colors usually employed consist of metallic oxides. Gold yields the most beautiful ruby, crimson, rose, and purple colors. Copper yields ruby red, and emerald green. Cobalt, rich deep blues. Iron, dull green; with alumina, flesh color; combined with chloride of silver, orange yellow. Silver with alumina, beautiful yellow. Uranium, chrysoprase green and canary yellow.

**GLASS MEASURE.** - 1 stone = 5 lbs.; 24 stone = 1 sear.

## GLASS.

SIZE.	NO. SIZE.	NO. SIZE.	NO. SIZE.	NO. SIZE.	NO. SIZE.
6 hyr-150	12 hyr-27-27	15 hyr-24	20 hyr-42-9		
7 " 9-15	12 " 24-25	15 " 26-19	18 " 46-9		
8 " 10-10	12 " 26-22	15 " 28-17	18 " 50-8		
9 " 11-82	12 " 28-22	15 " 30-16	18 " 52-8		
10 " 12-75	12 " 30-20	15 " 32-15	18 " 56-7		
11 " 13-71	12 " 32-19	15 " 34-14	18 " 60-7		
12 " 12-67	12 " 34-18	15 " 36-13	18 " 62-6		
13 " 13-62	12 " 36-17	15 " 38-13	18 " 64-5		
14 " 14-57	12 " 38-16	15 " 40-12	18 " 66-4		
15 " 15-53	12 " 40-15	15 " 42-11	18 " 68-3		
16 " 16-50	12 " 42-14	15 " 44-10	18 " 70-2		
17 " 17-46	12 " 44-13	15 " 46-9	18 " 72-1		
18 " 18-43	12 " 46-12	15 " 48-8	18 " 74-0		
19 " 19-40	12 " 48-11	15 " 50-7	18 " 76-0		
20 " 20-37	12 " 50-10	15 " 52-6	18 " 78-0		
21 " 21-34	12 " 52-9	15 " 54-5	18 " 80-0		
22 " 22-31	12 " 54-8	15 " 56-4	18 " 82-0		
23 " 23-28	12 " 56-7	15 " 58-3	18 " 84-0		
24 " 24-25	12 " 58-6	15 " 60-2	18 " 86-0		
25 " 25-22	12 " 60-5	15 " 62-1	18 " 88-0		
26 " 26-19	12 " 62-4	15 " 64-0	18 " 90-0		
27 " 27-16	12 " 64-3	15 " 66-0	18 " 92-0		
28 " 28-13	12 " 66-2	15 " 68-0	18 " 94-0		
29 " 29-10	12 " 68-1	15 " 70-0	18 " 96-0		
30 " 30-7	12 " 70-0	15 " 72-0	18 " 98-0		
31 " 31-4	12 " 72-0	15 " 74-0	18 " 100-0		
32 " 32-1	12 " 74-0	15 " 76-0	18 " 102-0		
33 " 33-0	12 " 76-0	15 " 78-0	18 " 104-0		
34 " 34-0	12 " 78-0	15 " 80-0	18 " 106-0		
35 " 35-0	12 " 80-0	15 " 82-0	18 " 108-0		
36 " 36-0	12 " 82-0	15 " 84-0	18 " 110-0		
37 " 37-0	12 " 84-0	15 " 86-0	18 " 112-0		
38 " 38-0	12 " 86-0	15 " 88-0	18 " 114-0		
39 " 39-0	12 " 88-0	15 " 90-0	18 " 116-0		
40 " 40-0	12 " 90-0	15 " 92-0	18 " 118-0		
41 " 41-0	12 " 92-0	15 " 94-0	18 " 120-0		
42 " 42-0	12 " 94-0	15 " 96-0	18 " 122-0		
43 " 43-0	12 " 96-0	15 " 98-0	18 " 124-0		
44 " 44-0	12 " 98-0	15 " 100-0	18 " 126-0		
45 " 45-0	12 " 100-0	15 " 102-0	18 " 128-0		
46 " 46-0	12 " 102-0	15 " 104-0	18 " 130-0		
47 " 47-0	12 " 104-0	15 " 106-0	18 " 132-0		
48 " 48-0	12 " 106-0	15 " 108-0	18 " 134-0		
49 " 49-0	12 " 108-0	15 " 110-0	18 " 136-0		
50 " 50-0	12 " 110-0	15 " 112-0	18 " 138-0		
51 " 51-0	12 " 112-0	15 " 114-0	18 " 140-0		
52 " 52-0	12 " 114-0	15 " 116-0	18 " 142-0		
53 " 53-0	12 " 116-0	15 " 118-0	18 " 144-0		
54 " 54-0	12 " 118-0	15 " 120-0	18 " 146-0		
55 " 55-0	12 " 120-0	15 " 122-0	18 " 148-0		
56 " 56-0	12 " 122-0	15 " 124-0	18 " 150-0		
57 " 57-0	12 " 124-0	15 " 126-0	18 " 152-0		
58 " 58-0	12 " 126-0	15 " 128-0	18 " 154-0		
59 " 59-0	12 " 128-0	15 " 130-0	18 " 156-0		
60 " 60-0	12 " 130-0	15 " 132-0	18 " 158-0		
61 " 61-0	12 " 132-0	15 " 134-0	18 " 160-0		
62 " 62-0	12 " 134-0	15 " 136-0	18 " 162-0		
63 " 63-0	12 " 136-0	15 " 138-0	18 " 164-0		
64 " 64-0	12 " 138-0	15 " 140-0	18 " 166-0		
65 " 65-0	12 " 140-0	15 " 142-0	18 " 168-0		
66 " 66-0	12 " 142-0	15 " 144-0	18 " 170-0		
67 " 67-0	12 " 144-0	15 " 146-0	18 " 172-0		
68 " 68-0	12 " 146-0	15 " 148-0	18 " 174-0		
69 " 69-0	12 " 148-0	15 " 150-0	18 " 176-0		
70 " 70-0	12 " 150-0	15 " 152-0	18 " 178-0		
71 " 71-0	12 " 152-0	15 " 154-0	18 " 180-0		
72 " 72-0	12 " 154-0	15 " 156-0	18 " 182-0		
73 " 73-0	12 " 156-0	15 " 158-0	18 " 184-0		
74 " 74-0	12 " 158-0	15 " 160-0	18 " 186-0		
75 " 75-0	12 " 160-0	15 " 162-0	18 " 188-0		
76 " 76-0	12 " 162-0	15 " 164-0	18 " 190-0		
77 " 77-0	12 " 164-0	15 " 166-0	18 " 192-0		
78 " 78-0	12 " 166-0	15 " 168-0	18 " 194-0		
79 " 79-0	12 " 168-0	15 " 170-0	18 " 196-0		
80 " 80-0	12 " 170-0	15 " 172-0	18 " 198-0		
81 " 81-0	12 " 172-0	15 " 174-0	18 " 200-0		
82 " 82-0	12 " 174-0	15 " 176-0	18 " 202-0		
83 " 83-0	12 " 176-0	15 " 178-0	18 " 204-0		
84 " 84-0	12 " 178-0	15 " 180-0	18 " 206-0		
85 " 85-0	12 " 180-0	15 " 182-0	18 " 208-0		
86 " 86-0	12 " 182-0	15 " 184-0	18 " 210-0		
87 " 87-0	12 " 184-0	15 " 186-0	18 " 212-0		
88 " 88-0	12 " 186-0	15 " 188-0	18 " 214-0		
89 " 89-0	12 " 188-0	15 " 190-0	18 " 216-0		
90 " 90-0	12 " 190-0	15 " 192-0	18 " 218-0		
91 " 91-0	12 " 192-0	15 " 194-0	18 " 220-0		
92 " 92-0	12 " 194-0	15 " 196-0	18 " 222-0		
93 " 93-0	12 " 196-0	15 " 198-0	18 " 224-0		
94 " 94-0	12 " 198-0	15 " 200-0	18 " 226-0		
95 " 95-0	12 " 200-0	15 " 202-0	18 " 228-0		
96 " 96-0	12 " 202-0	15 " 204-0	18 " 230-0		
97 " 97-0	12 " 204-0	15 " 206-0	18 " 232-0		
98 " 98-0	12 " 206-0	15 " 208-0	18 " 234-0		
99 " 99-0	12 " 208-0	15 " 210-0	18 " 236-0		
100 " 100-0	12 " 210-0	15 " 212-0	18 " 238-0		
101 " 101-0	12 " 212-0	15 " 214-0	18 " 240-0		
102 " 102-0	12 " 214-0	15 " 216-0	18 " 242-0		
103 " 103-0	12 " 216-0	15 " 218-0	18 " 244-0		
104 " 104-0	12 " 218-0	15 " 220-0	18 " 246-0		
105 " 105-0	12 " 220-0	15 " 222-0	18 " 248-0		
106 " 106-0	12 " 222-0	15 " 224-0	18 " 250-0		
107 " 107-0	12 " 224-0	15 " 226-0	18 " 252-0		
108 " 108-0	12 " 226-0	15 " 228-0	18 " 254-0		
109 " 109-0	12 " 228-0	15 " 230-0	18 " 256-0		
110 " 110-0	12 " 230-0	15 " 232-0	18 " 258-0		
111 " 111-0	12 " 232-0	15 " 234-0	18 " 260-0		
112 " 112-0	12 " 234-0	15 " 236-0	18 " 262-0		
113 " 113-0	12 " 236-0	15 " 238-0	18 " 264-0		
114 " 114-0	12 " 238-0	15 " 240-0	18 " 266-0		
115 " 115-0	12 " 240-0	15 " 242-0	18 " 268-0		
116 " 116-0	12 " 242-0	15 " 244-0	18 " 270-0		
117 " 117-0	12 " 244-0	15 " 246-0	18 " 272-0		
118 " 118-0	12 " 246-0	15 " 248-0	18 " 274-0		
119 " 119-0	12 " 248-0	15 " 250-0	18 " 276-0		
120 " 120-0	12 " 250-0	15 " 252-0	18 " 278-0		
121 " 121-0	12 " 252-0	15 " 254-0	18 " 280-0		
122 " 122-0	12 " 254-0	15 " 256-0	18 " 282-0		
123 " 123-0	12 " 256-0	15 " 258-0	18 " 284-0		
124 " 124-0	12 " 258-0	15 " 260-0	18 " 286-0		
125 " 125-0	12 " 260-0	15 " 262-0	18 " 288-0		
126 " 126-0	12 " 262-0	15 " 264-0	18 " 290-0		
127 " 127-0	12 " 264-0	15 " 266-0	18 " 292-0		
128 " 128-0	12 " 266-0	15 " 268-0	18 " 294-0		
129 " 129-0	12 " 268-0	15 " 270-0	18 " 296-0		
130 " 130-0	12 " 270-0	15 " 272-0	18 " 298-0		
131 " 131-0	12 " 272-0	15 " 274-0	18 " 300-0		
132 " 132-0	12 " 274-0	15 " 276-0	18 " 302-0		
133 " 133-0	12 " 276-0	15 " 278-0	18 " 304-0		
134 " 134-0	12 " 278-0	15 " 280-0	18 " 306-0		
135 " 135-0	12 " 280-0	15 " 282-0	18 " 308-0		
136 " 136-0	12 " 282-0	15 " 284-0	18 " 310-0		
137 " 137-0	12 " 284-0	15 " 286-0	18 " 312-0		
138 " 138-0	12 " 286-0	15 " 288-0	18 " 314-0		
139 " 139-0	12 " 288-0	15 " 290-0	18 " 316-0		
140 " 140-0	12 " 290-0	15 " 292-0	18 " 318-0		
141 " 141-0	12 " 292-0	15 " 294-0	18 " 320-0		
142 " 142-0	12 " 2				



## WEIGHTS & MEASURES

**HARDESS OF MINERALS.** Scale of.—In the following list, any substance will scratch the one immediately following it: Diamond, sapphire, topaz, quartz, feldspar, scapolite, apatite, fluor spar, calc spar, mica, gypsum, talc.

**HAY.** Number of Cubic Feet in a Ton.—Timothy, a year in mow or stack, 500 cu ft. Timothy, from bottom of stack, 400 " Timothy, newly stacked, 700 " Timothy and clover, old stacked, 600 " Timothy and clover, new, 800 " Clover, stacked, old, 700 " Clover, new, 900 " Common meadow hay, old, 800 " Common meadow hay, new, 1,000 "

**HAIR.** Length, etc., of.—The length to which hair may grow normally, especially in women, is very considerable, 74 inches having been exhibited in the "Hair Courts" of the International Exhibition (1892).

Adam Kirpen, of Chicago, is reported to have sold a crop of whiskers in 1861, the length of which was 5 feet, and that subsequently they grew to the length of 12 feet.

Hair which is lightest in color is also lightest in weight. Light or blonde hair is generally the most luxuriant, and it has been calculated that the average number of hairs of this color on an average person's head is 140,000; while the number of brown hairs is 110,000, and black, 103,000.

**HAY AND STRAW WEIGHT.**—36 lbs. straw = 1 truss; 56 lbs. old hay = 1 truss; 60 lbs. new hay = 1 truss; 36 trusses = 1 load.

**HEAD MEASUREMENTS.**—Most of great men have had great heads. Webster's head measured over 24 inches; Clay's, over 23; Napoleon's, nearly 24; Hamilton's, 23½. Burks, Jefferson's, and Franklin's heads were very large. Small and average heads may astonish us by their brilliancy and learning, but fail in that commanding greatness which impresses and sways. (See Brain, weight of).

The general rule for the head-measurements of adults is as follows:—Smallest size compatible with fair talents, 20½; moderate, 20 to 21½; average, 21½ to 22; Full, 22 to 23½; large, 23½ to 23¾, very large, above 23¾.

**HEAT.**—See Temperatures.  
**HEAT CONDUCTORS.**—Heat is communicated in three ways: viz., Conduction, Convection, and Radiation.

The relative conducting power of metals is as follows:—Silver, 100; copper, 74; gold, 53; brass, 24; tin, 15; iron, 12; lead, 9; platinum, 8; German silver, 6; bismuth, 2.

Of articles of clothing, linen, cotton, silk, wool, furs.

Liquids and gases are poor conductors, but good convectors of heat.

(See Radiation).

**HEAT, SPECIFIC.**—See Specific Heat.

**HEAT VALUE OF FUELS.**—Pounds of water evaporated by 1 lb. of fuel are as follows: Straw, 1.9; wood, 3.1; peat, 3.8; coke or charcoal, 6.4; coal, 7.9; petroleum, 14.6.

**HEIGHT AND WEIGHT AT DIFFERENT AGES.**—See Man and Woman (index).

**HEIGHT AND WEIGHT.** Relative.—The following are the average relative heights and weights of persons in health, as obtained by Dr. Hutchinson from over five thousand individuals:  
5 ft. 1 in. .... 120 lbs. 5 ft. 7 in. .... 148 lbs.  
5 " 2 " .... 125 " 5 " 8 " .... 152 " "  
5 " 3 " .... 133 " 5 " 9 " .... 166 " "  
5 " 4 " .... 139 " 5 " 10 " .... 169 " "  
5 " 5 " .... 142 " 5 " 11 " .... 174 " "  
5 " 6 " .... 145 " 6 " 00 " .... 178 " "

**HEIGHT BY THERMOMETER AND BAROMETER.**—See Barometer, also Water.

**HEMP ROPE.** Weights it will bear with Safety.—

CIRCUMFERENCE.	WEIGHT.	CIRCUMFERENCE.	WEIGHT.
1 inch.....	200 lbs.	3 inches.....	1800 lbs.
1½ ".....	312 " "	3½ ".....	2112 " "
1¾ ".....	450 " "	3¾ ".....	2450 " "
2 ".....	612 " "	4 ".....	2812 " "
2 ½ ".....	800 " "	4 ½ ".....	3200 " "
2¾ ".....	1012 " "	5 ".....	4000 " "
3 ".....	1250 " "	5 ½ ".....	5000 " "
3 ½ ".....	1512 " "	6 ".....	7200 " "

**HILLS IN AN ACRE OF GROUND.**—

40 feet apart, 27 hills.	8 feet apart, 680 hills.
25 " " 35 " "	6 " " 1,210 " "
20 " " 48 " "	5 " " 1,760 " "
15 " " 69 " "	4 " " 2,556 " "
10 " " 108 " "	3 " " 4,840 " "
7 ½ " " 193 " "	2½ " " 8,369 " "
6 " " 302 " "	2 " " 10,890 " "
5 " " 435 " "	1 " " 43,560 " "

**HOGS.** Comparative Live and Dressed Weights.—Twenty pigs were well fed, and fattened with results as follows:

No. LIVE.	DRESSED.	No. LIVE.	DRESSED.
1 172 lbs.	143 lbs.	11 121 lbs.	102 lbs.
2 151 " "	128 " "	12 175 " "	144 " "
3 150 " "	126 " "	13 149 " "	119 " "
4 130 " "	107 " "	14 150 " "	125 " "
5 136 " "	117 " "	15 167 " "	141 " "
6 162 " "	135 " "	16 150 " "	122 " "
7 135 " "	109 " "	17 131 " "	113 " "
8 136 " "	118 " "	18 170 " "	141 " "
9 153 " "	128 " "	19 130 " "	112 " "
10 160 " "	130 " "	20 120 " "	97 " "

Total Live Wt., 2,942—Dressed Wt., 2,452

**HORSE POWER.**—To estimate the work of any force, acting through a limited period of time, a unit of work has been adopted, called the horse-power. (See Foot-pound). A horse-power is the mechanical value of a force capable of raising thirty-two thousand pounds one foot in one minute. Its work is equal to thirty-two thousand foot-pounds in a minute.

**HORSE-DRAWING CAPACITY.**—On metal rails a horse can draw:—One and two-thirds times more than on asphalt pavement; three and one-third time more than on good Belgian blocks;

Five times more than on ordinary Belgian blocks;

Seven times more than on good cobble-stones;

Thirteen times more than on ordinary cobble-stones;

Twenty times more than on an ordinary earth road;

Forty times more than on sand.

A horse can drag, as compared with what he can carry on his back, in the following proportions:—On earth road, three times more; macadamized road, nine; plank twenty; on stone trackway, thirty-three; on a good railway, fifty-four times as much.

**HOUSEHOLD MEASURES.**—See Cooks.

**HUMAN BODY.** Composition of.—See Chemistry of the Body (index).

**HUMAN LIFE.** Average Length of.—The average length of human life is placed at thirty-two years. (See Life, 50 years of).

**HUMAN RESPIRATION.**—At each inspiration of a man, about 17 cubic inches of air pass into the lungs, and this is repeated 20 times a minute, making a cubic foot in 5½ minutes; 274 cubic feet in 24 hours. The capacity of the lungs is about 340 cubic inches.

**HUMAN CIVILIZATION.** Grades of.—1. Lowest Grade of Savagery. 2. Middle Grade of Savagery. 3. Upper Grade of Savagery. 4. Lowest Grade of Barbarism. 5. Middle Grade of Barbarism. 6. Upper Grade of Barbarism. 7. Civilization.

**ICE.** Strength of.—

Ice two inches thick will sustain a man. Four inches thick, a man on horseback.

Five inches, an 80-pound gun. Six inches, a team with small load.

Eight inches, a team with heavy load. Ten inches, an innumerable multitude.

**INCH OF RAIN.**—An "inch of rain" means a gallon of water spread over a surface of ten by two square feet, or 3,630 cubic feet (=100 tons) upon an acre.

**INCUBATION.** Time required for hatching Eggs.—See Gestation.

**INKS AND PAINTS.** MIXTURES of Fox Tints.—

Brown = red and black mixed together. Buff = yellow, white, and a little Venetian red.

Chestnut = white and brown. Chocolate = black and Venetian red.

Claret = red, amber, black. Copper = red, yellow, black.

Cream = white, yellow, Venetian red. Dove = white, vermilion, blue, yellow.

Drab = amber, white, Venetian red. Fawn = white, yellow, red.

Flesh Color = white, lake, vermillion. Freestone = red, black, yellow ochre, vermillion.

Gold = white, stone ochre, red. Gray = white lead, black.

Green (Silver) = indigo and lampblack. Green (Pearl) = white, black, black.

Green Bronze = chrome green, black, yellow. Green (Bright) = white and green.

Green (Dark) = light green and black. Green (Pearl) = white and green.

Green (Brilliant) = white and emerald green. Lead Color = white and lampblack.

Lemons = white, chrome yellow. Limestone = white, chrome yellow, black, red.

Olive = yellow, black, white. Orange = yellow and red.

Peach = white and vermillion. Pearl = white, black, blue.

Pink = white and carmine. Purple = violet, with more red and white.

Rose = white and lake. Sandstone = white, yellow ochre, black, red.

Snuff = yellow, Vanduke brown. Straw Color = white and yellow.

Violet = red, blue, white. White (French) = purple and white.

**INSECTS.** Strength of.—A beetle recently exhibited at a scientific exhibition, gave rise to the following as to its strength:—Weight of beetle, two grains; weight moved by it, 3½ ounces—1320 times the weight of the beetle! Were man's strength equal in proportion, he could move nearly 100 tons.

WEIGHTS & CONTIN  
MEASURES UED.

**INSPIRATION, Frequency of.**—At birth the inspirations are from 70 to 23; from the ages of from 15 to 20 years, from 24 to 16; from the ages of from 30 to 50, 23 to 11.

**INTOXICATION, Stages of.**—Several stages may be noted in the progress of intoxication. First Stage. This is characterized by liveliness and excitability, the circulation of the blood is more free, the bodily functions are performed with greater freedom, the mental faculties are more active, and there is a feeling of confidence and strength.

**Second Stage.** In this stage all the peculiarities of character, the weaknesses and failings of temperament, which are concealed in sobriety, manifest themselves. **Third Stage.** Consciousness becomes still more weakened, bodily balance is lost, and the brain becomes dizzy. **Fourth or last Stage.** The victim sinks into a heavy slumber, appetite for food fails, the cheeks become hollow or bloated, the vigor of the frame is so lessened as to culminate in delirium tremens.

**IRON.** Different Values of.—A bar of iron worth \$5, worked into horseshoes, advances in value to \$10; made into needles, is worth \$350; made into penknife-blades is worth \$3285; made into balance-springs of watches, is worth \$250,000.

502° to 686°—Violet, Purple, and dull blue.  
 932°—Covered with light coating of oxide.  
 977°—Becomes Nascent Red.  
 1292°—Sombre Red.  
 1472°—Nascent Cherry.  
 1657°—Cherry.  
 1832°—Bright Cherry.  
 2012°—Dull Orange.  
 2192°—Bright Orange.  
 2372°—White.  
 2552°—Brilliant White—welding heat.  
 2732° to 2912°—Dazzling White.

IRON AND STEEL, Breaking and Crushing Strains.—

	IN. OF SECTION
Breaking strain of wrought iron..	23
Crushing " " " "	17
Breaking strain of cast iron...	7½
Crushing " " " "	50
Breaking strain of steel bars ..	50
Crushing " " " "	166

**IRON**, Weight of.— See Metals.

**IRON AND LEAD MEASURE.-**  
14 Pounds = 1 Stone; 2½ Stone = 1 Pig  
8 Pigs = 1 Fother.

**IRON RAILS.** *Durability of.*—The average life of an iron rail is 15,000,000 tons, or equal to 100,000 trains of 150 tons each. The average time in years is about 5; but this depends upon the amount of traffic over the road. Steel rails are only half worn out with 95,600,000 tons of traffic, making the time in years upward of 18.

**JEWISH WEIGHTS, Reduced to English**  
Troy Weight -

The Gerah (1/2 Shekel) = 0 lbs. 0 oz. 0 pwt. 12 gr.  
The Bekah (1/2 Shekel) = 0 " 0 " 5 " 0  
The Shekel = 0 " 0 " 10 " 0  
The Maneh (60 Shekels) = 2 " 6 " 0 " 0  
The Talent (3000 " ) = 125 " 0 " 0 " 0

## KNOTS AND STATUTE MILES.—

The circumference of the earth is divided into 360 degrees, each degree into 60 minutes or nautical miles, consequently the circumference of the earth—viz. 131,385,456 feet—divided by (360x60)=21,600 gives the length of a knot, viz. 6,082.66 feet, which is generally considered the standard, except by the Admiralty. The Admiralty knot is 6,080 feet: the statute mile being 5,280 feet.

One knot equals 1.1515 miles, consequently to find the equivalents of knots in miles, multiply the number of knots by 1.1515.

**LABOR**, Value of to the Commonwealth  
Dr. Farr estimates the value of an agricultural laborer to the commonwealth as follows:

AGE.	VALUE	AGE.	VALUE	AGE.	VALUE
5.....	\$ 280	30....	\$ 1205	55.....	\$ 6100
10.....	585	35....	1140	60.....	4800
15.....	960	40....	1060	65.....	2300
20.....	1170	45....	965	70.....	1200
25.....	1230	50....	840	75.....	1100

The minus sign shows a loss to the commonwealth. Intellectual workers are often of much value after the age of 70.

**LAND MEASURE.**—A Township is 36 sections, each a mile square, and containing 36 acres. A quarter section is one half mile square and contains 160 acres. An eighth section is one half a mile long north and south, a quarter mile wide, and contains 80 acres. A sixteenth section is a quarter mile square and contains 40 acres.

The sections of a township are numbered from 1 to 36, commencing at the northeast corner, thus:

6	5	4	3	2	N.W. S.W.	N.E. S.E.
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

The sections are all divided into quarters, which are named by the cardinal points, as in section 1. The quarters are divided in the same way. The description of a forty-acre farm would read thus: The south half of the west half of the southeast quarter of section 1, township 24, north, range 7 west, or as the case might be; owing to the meridians converging toward the north, and diverging toward the south, will sometimes fall short, and sometimes overrun the number of acres it is supposed to contain.

A lot with any of these dimensions—221 ac.

WIDTH	LENGTH	WIDTH	LENGTH
5 yards by	968 yards.	10 yards by	483 yards.
20 " "	242 " "	50 " "	97 " "
80 " "	604 " "	47 " "	103 " "
16 " "	303 " "	30 " "	161 " "
59 " "	82 " "	40 " "	121 " "
70 " "	69 " "	55 " "	88 " "

The side of a square to contain  
 1 acre = 208.71 feet, or 12.65 rods, or 64 paces.

"	= 147.58	"	8.94	"	45	"
"	= 120.59	"	7.30	"	37	"
"	= 104.36	"	6.32	"	32	"
"	= 77.79	"	4.47	"	22 $\frac{1}{2}$	"

LAND OR SQUARE MEASURE.—144  
sq. in. = 1 sq. ft.; 9 sq. ft. = 1 sq. yd.;  $30\frac{1}{4}$  sq. yds.  
= 1 sq. rod; 40 sq. rods = 1 rood; 4 roods = 1 acre.

Also for Surveyors' measure, 7.92 inches = 1 link; 25 links = 1 rod; 4 rods = 1 chain; 10 square chains, or 160 square rods = 1 acre; 640 acres = 1 square mile.

**POTENT HEAT.**—A pound of water at  $212^{\circ}$  mixed with a pound of water at  $32^{\circ}$  gives two pounds at the mean temperature of  $122^{\circ}$ ; but a pound of water at  $212^{\circ}$  mixed with a pound of ice at  $32^{\circ}$ , gives two pounds of water having a temperature of only  $51^{\circ}$ . In this case the water has lost  $161^{\circ}$ , while the ice has gained only  $19^{\circ}$ , so that  $142^{\circ}$  have disappeared in changing the ice to water. This  $142^{\circ}$ , which is not sensible to the thermometer, is called latent heat.

The latent heat of water is of the greatest value in nature, and were it not for this provision, the inhabitants of northern valleys would be exposed to terrific inundations at every approach of spring.

Every solid has its own latent heat, which is called the heat of fusion, or the latent heat of liquids. In the subjoined table the second column of figures shows the number of pounds of water that would be raised one degree by the solidifying of one pound of the substance named. The first column is the heat of fusion.

	°m Fahr.	Water=1.
Water. . . . .	142.65	1.000
Zinc. . . . .	50.63	.355
Tin. . . . .	25.65	.179
Sulphur. . . . .	16.85	.118
Lead. . . . .	9.65	.067
Mercury. . . . .	5.11	.035

**LEVEL, TABLE SHOWING TRUE AND AP-  
PARENT.**—A true level coincides with the  
sphericity of the earth, while an apparent  
level consists of a continuation of the level  
plain drawn through the point at which  
the observation is made. (See also Distance  
One can See).

Dist. YDS.	Diff. of Level INCHES	Dist. YDS.	Diff. of Level INCHES	Dist. YDS.	Diff. of Level INCHES
100	0.026	900	2.081	1700	7.425
200	0.103	1000	2.570	1800	8.324
300	0.231	1100	3.110	1900	9.246
400	0.411	1200	3.701	2000	10.190
500	0.643	1300	4.344	2100	11.156
600	0.925	1400	5.038	2200	12.144
700	1.260	1500	5.784	2300	13.154
800	1.643	1600	6.580	2400	14.186

**LENGTH OF DAY AND NIGHT.**—(See also *Sunset and Sunrise Table*—index.) The inequality of day and night increases slowly in the tropical regions, but more and more rapidly toward the polar circles. Beyond these circles the Sun, in the hemisphere in which it is vertical, makes the entire circuit of the heavens, without sinking below the horizon, for a period varying from twenty-four hours to six months; while in the opposite hemisphere there is a corresponding period of continuous night.

The TABLE on the next page gives the length of the longest day and shortest night, in different latitudes, with the difference in length.





# WEIGHTS & MEASURES.

## MEDICINES, WITH PROPER DOSES.

For adults, give the full doses; from 14 to 20 years of age,  $\frac{3}{4}$  of full dose; 7 to 14 years,  $\frac{1}{2}$  dose; 4 to 7 years,  $\frac{1}{4}$  dose; 3 years,  $\frac{1}{8}$  dose; 2 years,  $\frac{1}{16}$  dose; 1 year,  $\frac{1}{32}$  dose; for babes, under 1 year, the dose should go down by months at the same rate as by years, for those over a year.

### Doses.

Arsenic, Fowler's Solution of.....	2 to 10 drops
Aconite, Extract of.....	$\frac{1}{16}$ to $\frac{1}{8}$ grain
Aconite, Tincture of.....	5 to 10 drops
Aloes, Purified.....	1 to 5 grains
Aloes, Pills of.....	1 to 4 pills
Asafoetida, Mixture of.....	$\frac{1}{4}$ to 2 table-spoonfuls
Asafoetida, Tincture of.....	$\frac{1}{4}$ to 2 table-spoonfuls
Belladonna, Extract of.....	$\frac{1}{16}$ to $\frac{1}{8}$ grain
Belladonna, Fluid Extract of.....	5 to 10 drops
Belladonna, Tincture of.....	5 to 30 drops
Bromide of Ammonia.....	5 to 20 grains
Bromide of Potassium.....	5 to 20 grains
Bromide of Sodium.....	5 to 20 grains
Calabar Bean, Extract of.....	$\frac{1}{4}$ to 1 grain
Calomel.....	$\frac{1}{16}$ to 10 grains
Camphor, Spirits of.....	5 to 15 drops
Camphor Water.....	1 to 4 table-spoonfuls
Capsicum, Tincture of.....	10 to 20 drops
Castor Oil.....	$\frac{1}{4}$ to 2 table-spoonful
Chloral, Hydrate of.....	5 to 30 grains
Cinchona, Sulphate of.....	5 to 30 grains
Cinchona, Compound Tincture of.....	1 to 4 table-spoonfuls
Cod Liver Oil.....	$\frac{1}{4}$ to 1 table-spoonful
Copper, Sulphate of.....	$\frac{1}{16}$ to $\frac{1}{8}$ grain
Corrosive Sublimate.....	$\frac{1}{16}$ to $\frac{1}{8}$ grain
Cream of Tartar.....	5 to 60 grains
Croton Oil.....	1 to 2 drops
Digitalis, Extract of.....	$\frac{1}{4}$ to 2 grains
Digitalis, Tincture of.....	5 to 60 drops
Dover's Powder.....	5 to 10 grains
Epsom Salts.....	$\frac{1}{4}$ to 2 table-spoonfuls
Iron, Extract of.....	1 to 5 grains
Hydrochloric Acid, dilute.....	1 to 5 drops
Iodine, Compound Tincture of.....	2 to 5 drops
Iodide of Potassium.....	5 to 20 grains
Ipecacuanha, Fluid Extract of.....	2 to 30 drops
Ipecacuanha, Syrup of.....	1 to 4 table-spoonfuls
Iron, Pyrophosphate of.....	2 to 5 grains
Iron, Tincture of the Chloride of.....	2 to 30 drops
Lactic Acid.....	15 to 30 drops
Laudanum.....	15 to 40 drops
Lead, Sugar of.....	$\frac{1}{4}$ to 5 grains
Mary Ann's Extract.....	2 to 8 grains
Mitic Acid, dilute.....	5 to 10 drops
Morphine.....	$\frac{1}{16}$ to $\frac{1}{8}$ grains
Magnesia, Sulphate of.....	$\frac{1}{4}$ to 2 table-spoonfuls
Muskard, Ground.....	1 to 2 table-spoonfuls
Nitre, Sweet Spirits of.....	$\frac{1}{4}$ to 1 table-spoonful
Nux Vomica, Tincture of.....	10 to 25 drops
Opium, Extract of.....	$\frac{1}{4}$ to 2 grains
Opium, Tincture of.....	15 to 40 drops
Paragoric.....	$\frac{1}{4}$ to 2 table-spoonfuls
Potassium, Bicarbonate of.....	5 to 20 grains
Potassium, Bromide of.....	5 to 20 grains
Potassium, Chlorate of.....	5 to 20 grains
Potassium, Iodide of.....	5 to 30 grains
Pepsin.....	5 to 10 grains
Quinine.....	2 to 10 grains
Senna, Fluid Extract of.....	1 table-spoonful
Soda, Bicarbonate of.....	5 to 20 grains
Stall, Syrup of.....	$\frac{1}{4}$ to 1 table-spoonful
Strichnia, Sulphate of.....	$\frac{1}{16}$ to $\frac{1}{8}$ grain
Turpentine, Spirits or Oil of.....	5 to 10 drops
Zinc, Oxide of.....	$\frac{1}{4}$ to 5 grains

## MELODY OF SINGING BIRDS, RANK OF.

The rank in melody of singing birds is as follows: The nightingale, linnet, titlark, skylark, and woodlark. The mockingbirds excel in imitative powers, and in variety of notes, in robin and goldfinch.

**AND MAN'S WEIGHT OF.**—The average weight of 20,000 men and women, weighed at Boston, Mass., was—men, 141½ lbs; women, 124½ lbs.

A crowd of people closely packed exerts a pressure of about 85 lbs. per square foot.

The average weight of a man is 140½ lbs.

The average weight of a strong cart horse is 14 cwt., and of a cavalry horse, 11 cwt.; a cow, 6½ to 8 cwt.; an ox, 1 to 9 cwt.; a pig, 1 to 2 cwt.; and a sheep,  $\frac{1}{4}$  to 1½ cwt.

**METALS, ALLOYS OF.**—(See also Compositions, Proportions of, and Coins, Fineness of.)

Bath Metal is composed of copper and tin.

Britannia Water is, antimony, copper, bismuth, bronze—tin and copper.

Canon Metal—tin and copper.

Dutch Gold—copper and zinc.

Mosaic Gold—copper and zinc.

Old standard Gold—gold, copper, silver.

Pewter—tin and lead.

Sheet Metal—lead and a little arsenic.

Solder—tin and lead.

Standard Gold—gold and copper.

Standard Silver—silver and copper.

Type Metal—lead and antimony.

White Copper—copper and arsenic.

**METALS, RELATIVE WEIGHTS OF.**—If Bar

Iron be taken as 100, then Cast Iron is 95; Steel, 102; Copper, 116; Brass, 109; Lead, 145.

If Cast Iron be 100, then Bar Iron is 107; Steel, 103; Brass, 116; Copper, 125; Lead, 156.

If Brass be 100, then Bar Iron is 92; Cast Iron 86; Steel, 93; Copper, 105; Lead, 125.

If Copper be 100, then Bar Iron is 87; Cast Iron, 82; Steel, 88; Brass, 93; Lead, 128.

If Lead be 100, then Bar Iron is 68; Cast Iron, 64; Steel, 69; Brass, 74; Copper, 78.

**METALS, RELATIVE POWERS OF TO CONDUCT ELECTRICITY.**—(See Heat Conductors.)

Silver is the best conductor of electricity, then copper, gold, zinc, iron, tin, lead, antimony, and bismuth, in the order as given.

**METALS, RELATIVE VALUES.**—While the value of any one metal cannot be regarded as constant, it has an average value; and many of the more rare metals do not exist in large quantities, yet, in order to compare the values, they are considered as existing in at least one pound (avoirdupois) quantities. In the subjoined list the prices are the average per pound.

**METAL. PRICE. METAL. PRICE. METAL. PRICE.**

Gold.....\$48,000.00. Silver.....\$2,200.00. Platinum.....\$16.00.

Vanadium.....0.000.00. Barium.....1,800.00. Cobalt.....16.00.

Ruthidium.....9,070.00. Palladium.....4,000.00. Sodium.....8.00.

Zirconium.....7,200.00. Osmium.....1,300.00. Nickel.....5.00.

Lithium.....7,000.00. Iridium.....1,090.00. Cadmium.....4.00.

Glucium.....3,400.00. Uranium.....900.00. Aluminum.....3.00.

Calcium.....4,500.00. Titanium.....688.00. Bismuth.....2.50.

Strontium.....4,200.00. Oeridium.....500.00. Mercury......50.

Terbium.....4,080.00. Gold......330.00. Arsenic......50.

Vanadium.....4,080.00. Molybdenum.....225.00. Tin......25.

Erbium.....3,400.00. Thallium.....225.00. Copper......25.

Cerium.....3,400.00. Platinum.....150.00. Antimony......41.

Dysprosium.....3,200.00. Manganese.....130.00. Zinc......41.

Indium.....3,200.00. Tungsten.....115.00. Lead......08.

## METRIC SYSTEM.

The metric system is so called as being based on the measurement of the earth. The metre, its fundamental measure, is the ten-millionth part of a meridian line drawn from the pole to the equator, and is 39.3709 English inches. The 100th of a metre is the Centimetre. The Gramme is a cubic centimetre of distilled water at the temperature of maximum density (39.2° F.), being 15.438 English grains, or .0022054 lb. avoirdupois. All the multiples and subdivisions of the current coins, as well as of every measure and weight, are decimal. This system was first adopted by France in 1795.

## METRIC WEIGHTS AND MEASURES.

### LINEAR MEASURE.

Mètre.....	= 3.2808992 feet
Décimètre (10 inches).....	= 32.808992 feet
Hecto-mètre (100 meters).....	= 323.08992 feet
Kilomètre (1,000 meters).....	= 1093.63 yards
Myriamètre (10,000 meters).....	= 6,213 miles
Décimètre (1 metre).....	= 3.93709 inches
Centimètre (0.1 metre).....	= .9371 inch
Millimètre (0.01 metre).....	= .03937 inch

### SUPERFICIAL MEASURE.

Are (100 sq. metres).....	= 119.60113 sq. yd.
Hectare (10,000 sq. metres).....	= 2,471.414 acres
Centiare (sq. metre).....	= 1.196033 sq. yd.

### MEASURE OF CAPACITY.

Litre (1 cubic decimetre).....	= 1.760773 pints
Décilitre (0.1 litres).....	= 2.200968 gals.
Hectolitre (100 litres).....	= 22.009688 gals.
Kilolitre (1,000 litres).....	= 220.09688 gals.
Décilitre (1 litre).....	= 0.17607 pint
Centilitre (0.1 litre).....	= 0.17607 pint

### SOLID MEASURE.

Stère (1 cubic metre).....	= 1.31 cubic yard
Décistère (10 stères).....	= 13 cu. yds., 2 feet, 2 inches
Décistère (1 stère).....	= 3 cu. ft., 9.87 cubic inches

### WEIGHTS.

Gramme.....	= 3.243249 grs. Troy
Déca-gramme (10 grams).....	= 3.6438 drms. avoird.
Hecto-gramme (100 grams).....	= 3.527 oz. avoird.
Kilo-gramme (1,000 grs.).....	= 2.20462 lb. avoird.
Quintal métrique (100 kilos).....	= 220.462 lb. avoird.
Millier, or tonneau (100 kilos).....	= 220.462 lb. avoird.
Déca-gramme (1 gramme).....	= 1.5432 grains
Centi-gramme (0.1 gramme).....	= 0.15432 grains
Milli-gramme (0.01 gramme).....	= 0.015432 grains

## METRIC WEIGHTS AND MEASURES.

To convert into English Weights & Measures.

To convert grammes into avoirdupois ounces, multiply by .0352; kilogrammes into avoirdupois lbs., multiply by 2.2046; litres into gallons, multiply by .2202; litres into pints, multiply by 1.762; milli-metres into inches, multiply by .3937; metres into yards, multiply by .9144.

## METRIC WEIGHTS AND MEASURES.

English Equivalents of.—An English mile = 5280 feet, an admiralty knot = 6080 feet, a kilometer = 3281 feet. An English mile is, therefore = 0.87 knot = 1.609 kilometers. Or 1 knot = 1.15 mile = 1.85 kilometre. Or 1 kilo-metre = 0.54 knot = 0.621 English mile, 1 metre = 39.37 inches; 1 square metre = 25.9 square feet; 1 square kilometre = 259 square inches = 10.76 square feet; 10 square feet = 0.929 square metres; 1 cubic metre = 1.308 cubic yards = 35.3 cubic feet; 1 cubic yard = 765 litres; 1 cubic foot = 28.3 litres; 1 litre = 61 cubic inches; 10 cubic inches = 0.1639 litres; 1 Hectolitre = 2.84 bushels = 35.2 litres; 1 tonneau, or millier = .384 English ton (of 2240 lbs.); 1 English ton = 1.016 tonneau.

## NAME OF CONVERSION OF.

English scales of.—English scales are: 1576 yards; Roman, 1628; Tuscan, 1808; German short, 6659—long, 10126; Irish, 2240; Danish, 8254; Swiss, 9153; Swedish, 11,700.



# WEIGHTS & CONTIN MEASURES U.S.

## MILK ANALYSIS OF

	Water	Fat	Casein	Sugar	Total
Woman	89.3	2.5	3.4	4.8	100
Cow	86.0	4.0	7.2	2.8	100
Ass	90.9	1.1	1.9	6.1	100
Goat	86.8	3.3	4.0	5.9	100
Evve	85.6	4.2	4.5	5.7	100

## MILK, CREAM, BUTTER, ETC.

The time required for the full amount of cream to rise to the surface of new milk at different temperatures may be seen from the following table.

10 to 12 hours with temperature of air 77° F	68"
18 to 20 " " " " " " " "	55"
24 " " " " " " " "	50"
36 " " " " " " " "	50"

A gallon of milk weighs 10 lbs. 4 ozs., being heavier than water in the proportion of 103 to 100. The best temperature at which to churn cream is from 55° to 60° Fahr., for milk 65° Fahr. Milk will produce scarcely any cream, even in the space of a month, if it is kept at 33° to 38°. Milk turns sour by the fermentation of the sugar, and its transformation into lactic acid, thus causing the milk to curdle; vinegar or rennet will produce the same effect. Good cream will produce about 1/4 of its weight of butter; cheese made from good milk contains nearly 33 per cent. of water; that from skim-milk 60 per cent.

## MISCELLANEOUS WEIGHTS AND MEASURES

See at close of this list.

## MINERALS, RELATIVE HARDNESS OF

See Hardness of Minerals.

## MIXED RACES, NAMES OF OFFSPRING

FATHER.	MOTHER.	MALE-OFFSPRING.	FEM.
White	Negro	Mulatto	Mulatta
White	Mulatto	Quarteron	Quarterona
White	Quarteron	Quintero	Quintera
White	Quintero	White	White
White	Indian	Mestizo	Mestiza
Negro	Indian	Zambo	Zambua
White	Chinese	Chino-blanco	
Negro	Chinese	Zambo-chino	
Mulatto	Chinese	Chino	

## MONUMENTS, TOWERS, DOMES, ETC.

Height, in Feet.	
Asinelli Tower, Italy	330
Babel, Tower of	680
Babec	500
Barlus of Notre Dame, Paris	216
Bartholdi Statue, New York	329
Belfry Tower, Bruges, Belgium	290
Bunker Hill Monument	221
Capitol, Washington	287
Cathedral, St. Petersburg	363
Cathedral, Escorial	200
Cathedral, St. Patrick's, New York	328
Cathedral, Northwich, England	315
Cathedral, Florence	384
Cathedral, Salisbury, England	404
Cathedral, Cronoma	392
Cathedral, Bremen, Ger.	324
Cathedral, Strasburg	468
Cathedral, Amiens, Fr.	422
Cathedral, Cologne	511
Cathedral, Antwerp	476
Cathedral, Rouen	482

Cathedral, Milan	438 feet
Cathedral, Mexico	280 "
Chicago Board of Trade	303 "
Chicago Water Tower	175 "
Chimney, St. Rollox, Glasgow	455 "
Chimney, Musprat's, Liverpool	406 "
City Hall, Philadelphia	535 "
Cleopatra's Needle, New York	68 "
Eiffel Tower, Paris	984 "
Giralda Tower, Spain	350 "
Grace Church, New York	216 "
High Bridge, New York	116 "
Hotel des Invalides, Paris	344 "
Hotel de Ville, Brussels	364 "
Leaning Tower, Pisa	188 "
Lincoln Cathedral, England	300 "
Masonic Temple, Philadelphia	230 "
Montmartre, London	230 "
Notre Dame Church, Antwerp	442 "
Paris Tower, Paris	314 "
Pompey's Pillar, Egypt	244 "
Porcelain Tower, China	200 "
Pyramid of Cheops, Egypt	320 "
Pyramid of King Shafra	347 "
Pyramid of Sakara	356 "
St. John's, New York	310 "
St. Mark's, Venice	328 "
St. Martin's, Landshut, Ger.	462 "
St. Mary's, Lubec	404 "
St. Paul's, New York	200 "
St. Paul's, London	366 "
St. Peter's, Rome	457 "
St. Steven's, Vienna	465 "
Torrazo Tower, Italy	396 "
Trinity Church, New York	286 "
Watkins Tower, London	1134 "
Washington Monument	555 "

## MUSIC, TABLE SHOWING THE NUMBER

of double Vibrations, of each Letter from the lowest to the highest.—There must be at least 32 vibrations or waves in one second of time, to produce a musical tone. It is the lowest musical sound recognized, and is denoted by the letter C; the length of the atmospheric wave of this letter is 35 feet, and is the length of an organ pipe producing this sound. Nine octaves above this (highest sound on any musical instrument) is accomplished through a pipe 1/8 of an inch in length.

In the 1st or lowest octave, C vibrates 32 times per second; D 36, E 40, F 42 1/2, G 48, A 52 1/2, B 60.

2nd Octave.—C 64, D 72, E 80, F 85 1/2, G 96, A 105, B 120.

3rd Octave.—C 128, D 144, E 160, F 170 1/2, G 192, A 210, B 240.

4th Octave.—C 256, D 288, E 320, F 340 1/2, G 384, A 420, B 480.

5th Octave.—C 512, D 576, E 640, F 680 1/2, G 768, A 840, B 960.

6th Octave.—C 1024, D 1152, E 1280, F 1360 1/2, G 1536, A 1680, B 1920.

7th Octave.—C 2048, D 2304, E 2560, F 2720, G 3072, A 3360, B 3840.

8th Octave.—C 4096, D 4608, E 5120, F 5440, G 6144, A 6720, B 7680.

9th Octave.—C 8192, D 9216, E 10240, F 10880, G 12288, A 13440, B 15360.

## NAILES, NUMBER USED IN CARPENTRY

To case and hang one door, 1 lb.  
To case and hang one window, 3 lb.  
Base, 100 linear feet, 1 lb.  
To put on rafters, joists, etc., 3 lb. to 1000 ft.  
To put up studding, 3 lb. to 1000 feet.  
To lay a 6-inch pine floor, 15 lb. to 1000 feet.

## NAILES AND TACKS, NUMBER PER POUND.

Size.	No. per lb.	Tacks.	No. per lb.
6 penny, length 2 inch.	80	1 oz.	1 inch, 16,000
8 " " " 2 1/2 "	50	1 1/2 "	11,000
10 " " " 3 "	34	2 "	8,000
12 " " " 3 1/2 "	29	2 1/2 "	6,400
3 " " Fine 1 1/2 "	760	3 " "	5,333
4 " " " 1 3/4 "	480	4 " "	4,000
4 " " " 1 3/8 "	300	6 " "	2,666
5 " " " 1 1/2 "	200	8 " "	2,000
6 " " " 1 1/4 "	160	10 " "	1,600
7 " " " 1 1/2 "	120	12 " "	1,333
8 " " " 1 3/4 "	92	14 " "	1,143
9 " " " 1 3/8 "	72	16 " "	1,000
10 " " " 1 3/4 "	60	18 " "	888
12 " " " 1 3/2 "	44	20 " "	727
20 " " " 1 1/2 "	24	24 " "	666
30 " " " 1 1/4 "	18		
40 " " " 1 1/2 "	14		
50 " " " 1 1/4 "	12		
60 " " " 1 1/2 "	10		

The term penny as applied to nails is generally supposed to have been derived from pound. It originally meant so many pounds to the thousand, i.e., 6 penny meant six pounds of nails to the thousand. The thousand was always understood, and six pound, eight pound, etc., were gradually shortened until the present term penny has entirely taken the place of pound.

This supposition is at odds with the above table.

**NATURAL SLOPE OF EARTH, WITH Horizontal Line.**—Gravel, average, 40° Sand, dry, 38°—wet, 22°; Earth, vegetable, 28°; Earth, compact, 50°; Rubble, 45°; Clay, dried, 45°—wet, 16°.

**NAUTICAL MEASURE.**—20 leagues = 1 degree; 360° = Earth's circumference; 51 feet = 1 knot for half-minute glasses; 45 feet = 1 knot for 28-second glasses. (See also Mariners', and Circular Measure.)

**NICOTINE, PERCENTAGE OF IN DIFFERENT KINDS OF TOBACCO.**—Havana, 2%; French, 6%; Virginia, 7%; Brazilian, upward of 7%.

## NORMAL TEMPERATURE OF ANIMALS

Expressed in Degrees of Fahrenheit.  
Glowworm 74 Elephant 99 Monkey 104 Snake 107 Porpoise 100 Sheep 104 Shark 77 Bat 100 Hog 105 Oyster 81 Rat 102 Skink 108 Serpent 98 Cat 102 Sparrow 109 Man 98 Dog 103 Pig 109 Horse 98 Elk 103 Chicken 111

## NUTRITIVE VALUE OF FOODS.

According to Frankland an average man confining himself to one article of food would require, to barely maintain life from day to day, 5.068 lbs. of potatoes; 1.156 lbs. of Cheshire cheese; 1.335 lbs. of pea-meal; 1.541 lbs. of ground rice; 2.345 lbs. of bread; 3.532 lbs. of lean beef; 4.3 lbs. of lean veal; 6.669 lbs. of whiting; 8.75 lbs. of white of egg; 9.865 lbs. of carrots; 12.02 lbs. of cabbage; 63 bottles of stout.

It has been ascertained by experiment, that an ordinary diet should contain one part of nitrogenous matter (proteids—composed of carbon, hydrogen, oxygen, and nitrogen), to about 4 parts of non-nitrogenous diet (fat, etc.). (See Food, Constituents, and of, etc.)

# WEIGHTS & MEASURES.

## OIL IN SEEDS, PERCENTAGE OF.-

Bitter Almond.....	55	Oats.....	61
Barley.....	25	Rapeseed.....	55
Clover hay.....	5	Sweet Almond.....	47
Hemp seed.....	19	Turnip seed.....	45
Indian corn.....	7	White mustard.....	34
Linsed.....	17	Wheat.....	3
Meadow hay.....	3	Wheat-straw.....	3
Oat straw.....	4	Wheat flour.....	3

**PAINTING, ETC.**—As an average 2 pound of paint should be allowed per square yard for the first coat, and about 1 lb. for each additional coat. One pound of stopping should be allowed for every 20 square yards.

Priming consists of white lead and linseed oil. Knotting consists of red lead and size. Putty consists of Spanish whiting and linseed oil.

**PAPER COUNTS.**—24 sheets = 1 quire; 10 1/2 quires = 1 token; 20 quires = 1 ream; 2 reams = 1 bundle; 5 bundles = 1 bale.

## PAPER, SIZE IN INCHES.—

PRINTING PAPER.	
Flat Letter.....	10x16
Extra Size Folio.....	10x23
Law Blank.....	13x16
Medium-Width Paper.....	15x24
Small Cap.....	13x16
Royal-Printing.....	20x24
Flat Cap.....	14x17
Medium-Printing.....	20x25
Crown.....	15x19
Double Cap.....	17x28
Demy.....	16x21
Sup. Royal-Width.....	20x28
Folio Post.....	17x22
Card Board.....	22x28
Check Folio.....	17x22
Sup. Royal-Print.....	22x28
Medium-Width.....	18x23
Imperial-Width.....	22x30
Medium.....	18x24
Imperial-Print.....	22x32

Of the different sizes there are also several different weights of each size, as Folio 16, 18, 24, etc., pounds per ream.

**BOOK AND NEWSPAPER.**  
This can now be obtained in any size called for, as modern facilities for the manufacture of paper enable the manufacturer to fill almost any order on a short notice.

## PAPER, NUMBER REQUIRED FOR A BOOK.

Any Size. The Table enables printers to ascertain the Number of Forms for a Book of any Size, and the Quantity of Paper necessary to print a thousand copies in any form, from Octavo to 36mo, half-sheet-wise. Example.—How many reams will be required for a 12mo Book containing 312 pages? Find the number of pages (312) in the 12mo column in the outer column on the left of the table the number of forms is seen (25), and in the number of forms on the right, the quantity of paper required is given (28 reams 2 qrs.).

FORMS	8va.	12mo.	16mo.	18mo.	24mo.	32mo.	36mo.	AMOUNT OF PAPER FOR 1000 COPIES.	REAMS. QRS.
1	8	12	16	18	24	32	36	1	2
2	16	24	32	36	48	64	72	2	4
3	24	36	48	54	72	96	108	3	6
4	32	48	64	72	96	128	144	4	8
5	40	60	80	90	120	160	180	5	10
6	48	72	96	108	144	192	216	6	12
7	56	84	112	126	168	224	252	7	14
8	64	96	128	144	192	256	288	8	16
9	72	108	144	162	216	288	324	9	18
10	80	120	160	180	240	320	360	10	20
11	88	132	176	198	264	352	396	11	22
12	96	144	192	216	288	384	432	12	24
13	104	152	208	234	312	416	468	13	26
14	112	168	224	252	336	448	504	14	28
15	120	180	240	270	360	480	540	15	30

FORMS	8va.	12mo.	16mo.	18mo.	24mo.	32mo.	36mo.	AMOUNT OF PAPER FOR 1000 COPIES.	REAMS. QRS.
16	128	192	256	288	384	512	576	16	32
17	136	204	272	306	408	544	608	17	34
18	144	216	288	324	432	576	648	18	36
19	152	228	304	342	456	608	684	19	38
20	160	240	320	360	480	648	720	20	40
21	168	252	336	378	504	672	756	21	42
22	176	264	352	396	528	704	792	22	44
23	184	276	368	414	552	736	828	23	46
24	192	288	384	432	576	768	864	24	48
25	200	300	400	450	600	800	900	25	50
26	208	312	416	468	624	832	936	26	52
27	216	324	432	486	648	864	972	27	54
28	224	336	448	504	672	896	1008	28	56
29	232	348	464	522	696	928	1044	29	58
30	240	360	480	540	720	960	1080	30	60
31	248	372	496	558	744	992	1116	31	62
32	256	384	512	576	768	1024	1152	32	64
33	264	396	528	594	792	1056	1188	33	66
34	272	408	544	612	816	1088	1224	34	68
35	280	420	560	630	840	1120	1260	35	70
36	288	432	576	648	864	1152	1296	36	72
37	296	444	592	666	888	1184	1332	37	74
38	304	456	608	684	912	1216	1368	38	76
39	312	468	624	702	936	1248	1404	39	78
40	320	480	640	720	960	1280	1440	40	80

## PENDULUM, LENGTH OF TO VIBRATE

Seconds at the Level of the Sea in various Places.	Latitude	Length of Pendulum
0° 00' 00"	0° 00'	39.0152 inches
45° 00' 00"	45° 00'	39.1270 "
Washington 38° 23' 30"	38° 23'	39.0958 "
New York 40° 43' 40"	40° 43'	39.1017 "
London 51° 31' 00"	51° 31'	39.1393 "
Stockholm 59° 21' 30"	59° 21'	39.1845 "

## PLASTERING.—

1 in. thick.	2 in. thick.	3 in. thick.
1 bu. cement will cover.....	1 1/2 sq. yd.	1 1/2 sq. yd.
1 bu. of sand will cover.....	2 1/2 "	3 "
1 bu. cement and 1 1/2 of sand will cover.....	3 1/2 "	4 1/2 "
2 of sand will cover.....	4 1/2 "	6 1/2 "
1 bu. cement and 3 of sand will cover.....	4 1/2 "	6 "
1 cubic yard of lime, 2 yards of sand, and 3 bu. of hair 70 lbs. will cover.....	60 "	60 "

## PLANNING TABLE, SHOWING THE QUANTITY OF SAND GLOVED BY A TEAM MOVING AT THE RATE OF TWO MILES PER HOUR, PER DAY OF 10 HOURS.

WIDTH OF FURROW.	LAND.	WIDTH OF FURROW.	LAND.
5 inches = 1.0 acre.	2 feet = 4.8 acres.		
6 " = 1.2 "	2 1/2 " = 6.0 "		
7 " = 1.4 "	3 " = 7.2 "		
8 " = 1.6 "	3 1/2 " = 8.4 "		
9 " = 1.8 "	4 " = 9.6 "		
10 " = 2.0 "	4 1/2 " = 10.8 "		
11 " = 2.2 "	5 " = 12.0 "		
12 " = 2.4 "	5 1/2 " = 13.2 "		
14 " = 2.8 "	6 " = 14.4 "		
16 " = 3.2 "	6 1/2 " = 15.6 "		
18 " = 3.6 "	7 " = 16.8 "		
20 " = 4.0 "	7 1/2 " = 18.0 "		
22 " = 4.4 "	8 " = 19.2 "		

## POWER, MEASURE.—The units of work, distance, and time, are respectively 1 pound, 1 foot, and 1 minute.

Man Power.—One man's power = .009 horse power = 3,000 units of work = 2,000 pounds raised vertically 1 foot in 1 minute, or its equivalent.

Horse Power.—One horse power = 11 men's power = 33,000 units of work = 20,000 pounds raised vertically 1 foot in 1 minute, or its equivalent.

POWER, STARTING.—A power of 250 tons is necessary to start a vessel weighing

3,000 tons over greased slides on a marine railway; when in motion, 150 tons only is required.

## PRESSURE, UNITS OF.—

Medium.	Pounds on 1 in. atm.	Pounds on 1 in. atm.
1 foot water 35.2	0.4335	67.425
1 foot water 62 1/2	0.4330	67.355
30 in. mercury 62 1/2	1.4725	212.0
1 in. mercury 32 1/2	0.4912	70.73
1 foot air.....	0.0006	0.0007
1 pound to the sq. in. = 2.3	1/2 water = 2 in. mer.	0.0004

**PRINTERS' G.M.**—A unit of print which will form a square; so named formerly when it was a square type. It is used as a unit to measure printed matter, composition being measured by the number of thousands and ems.

## PULSE, FREQUENCY OF BEATS.—

AGE.	Beats per minute.	AGE.	Beats per minute.
At birth.....	130 to 140	4 years.....	85 to 95
One month.....	120 to 125	7 years.....	80 to 90
One year.....	115 to 120	14 years.....	75 to 85
Two years.....	100 to 115	21 years.....	70 to 75
Three years.....	95 to 100	Old age.....	60 to 65

While the above are the average, there are many instances of very low pulse, ranging from 25 beats per minute to 40 and 50.

In certain diseases, such as acute dropsy of the brain, there may be from 150 to 200 beats per minute.

In women the pulse beats are much more rapid than in men.

**RADIATION.**—Lampblack has the highest emissive or radiating power known; the surfaces of paper, and other similar loose material are next in order. Polished metals are the poorest radiators.

**RAILROAD WEIGHTS.**—When it is not convenient to weigh the articles given in the sub joined table, they are billed at the weights as given.

Alc. Beer.....	220 lb.	per bl.	Hogwines 350 lb.	per bl.
" " " " " "	170 "	" "	Hun. Seed 45 "	bu.
" " " " " "	100 "	" "	Lime.....	200 "
Apples, dried 24 "	bu.	Malt.....	38 "	bu.
" green 56 "	bu.	Millst.....	45 "	"
" " " " " "	150 "	bbL Nails.....	100 "	keg.
Barley.....	48 "	bu.	Oats.....	32 "
Beans, white 60 "	bu.	" "	Oil.....	450 "
" " " " " "	46 "	bu.	Onions.....	57 "
" " " " " "	320 "	bu.	Peaches, dtd 33 "	bu.
Brans.....	20 "	bu.	Pork.....	320 "
Brooms 40 "	doz.	bbL " "	" "	150 "
Buckwheat 52 "	bu.	" "	" "	60 "
Cider.....	350 "	bu.	" " " "	56 "
Charcoal.....	22 "	bu.	" " " "	56 "
Cider Seed 60 "	bu.	" "	" " " "	56 "
Corn.....	56 "	bu.	" " " "	300 "
" " " " " "	70 "	bu.	" " " "	300 "
" " " " " "	220 "	bu.	" " " "	45 "
Eggs.....	200 "	bu.	" " " "	56 "
Fish.....	300 "	bu.	" " " "	56 "
Flax Seed 56 "	bu.	" "	" " " "	56 "
Flour.....	200 "	bu.	" " " "	56 "
Hemp Seed 44 "	bu.	" "	" " " "	56 "

## ROPE, QUALITIES OF DIFFERENT KINDS.—

Italian Hemp Rope is the standard of comparison and is taken as 1. All other wires differ except hide ropes.

ROPE.	STRENGTH.	DIFFERENCE.	STRENGTH.	DIFFERENCE.
Italian Hemp.....	0.7 to 0.9	0.8 to 0.9	1	1
Baltic.....	0.5 to 1	0.5 to 1	0.4 to 1 1/2	
Manilla.....	0.5 to 1	0.75	0.88	
Flax.....	0.9	low	0.8	
Coin Hair.....	0.2 to 0.5	low	0.43	
Green Hides.....	0.5	high	1	0.24
Iron Wire.....	8	high	4	
Steel.....	8	high	4	





## WEIGHTS & MEASURES.

**SEEDING, TIME FOR.**—The following table shows the time of sowing various seeds, and the quantity of seed per acre. The letter's signifies the months when the seeds may be sown:

SEED.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	QCT.	QUANTITY PER ACRE.
Red Clover.....	S	S	S	S	S	S	S	S	8 to 10 lbs.
Timothy.....	S	S	S	S	S	S	S	S	4 to 5 bush.
Red-top.....	S	S	S	S	S	S	S	S	4 to 5 "
Ky. Blue Grass.....	S	S	S	S	S	S	S	S	15 to 20 "
Hung. Grass.....	S	S	S	S	S	S	S	S	4 to 5 "
Millet.....	S	S	S	S	S	S	S	S	4 to 5 "
Sorghum Seed.....	S	S	S	S	S	S	S	S	2 quarts.
Flax Seed.....	S	S	S	S	S	S	S	S	4 to 5 bush.
Corn, hills.....	S	S	S	S	S	S	S	S	4 to 6 quarts.
Rye.....	S	S	S	S	S	S	S	S	1 to 2 bush.
Wheat.....	S	S	S	S	S	S	S	S	1 to 2 "
Oats.....	S	S	S	S	S	S	S	S	2 to 3 "
Buckwheat.....	S	S	S	S	S	S	S	S	4 to 5 "
Potatoes.....	S	S	S	S	S	S	S	S	10 to 15 "
S. Potatoes.....	S	S	S	S	S	S	S	S	Transplant.
Beets.....	S	S	S	S	S	S	S	S	4 to 10 lbs.
Carrots.....	S	S	S	S	S	S	S	S	2 to 3 "
Turnips.....	S	S	S	S	S	S	S	S	4 to 5 "
Parsnips.....	S	S	S	S	S	S	S	S	2 to 3 "
Onions.....	S	S	S	S	S	S	S	S	4 to 6 "
White Beans.....	S	S	S	S	S	S	S	S	2 to 3 bush.
Peas.....	S	S	S	S	S	S	S	S	1 to 2 "
Pumpkins.....	S	S	S	S	S	S	S	S	3 to 4 oz.
Barley.....	S	S	S	S	S	S	S	S	1 to 2 bush.
Corn, broadcast.....	S	S	S	S	S	S	S	S	2 to 3 "
Corn, drilled.....	S	S	S	S	S	S	S	S	2 to 3 "
Broom Corn.....	S	S	S	S	S	S	S	S	4 to 5 "
Cotton.....	S	S	S	S	S	S	S	S	1 to 3 "
Hemp.....	S	S	S	S	S	S	S	S	4 to 5 "
Tobacco.....	S	S	S	S	S	S	S	S	2 to 3 oz.

**SEEDS, VITALITY OF.**—Recent experiments have shown that out of 338 species, representing 74 natural orders, only 94 grow after 3 years; only 57 after 4 to 8 years; 16, from 8 to 21 years; 5, from 25 to 27 years; and 3, to 43 years. In ordinary cases, says Asa Gray, "leguminous seeds have longest retained their germinating power; in some very well authenticated instances up to 70, or perhaps 100 years. Nearly uniform temperature, darkness, and either dryness or burial beyond atmospheric influence, most favor the prolongation of vitality."

**SEXES, COMPARATIVE NUMBER AT A BIRTH.**—The celebrated Huxford, of Berlin, observes that the number of males born, to that of females, seems to be 21 to 20 over the whole earth, and before they reach the age of puberty, the proportion of the sexes is reduced to perfect equality, more boys than girls dying before reaching the age of fourteen.

His conclusions are as follows:—1st. There is an equal number of males and females born in the human race; 2nd. The equality occurs every day in a population of ten millions; 3rd. It occurs every week in 100,000; 4th. It occurs every month in 50,000; 5th. Every year in 10,000; 6th. In small societies every ten or fifteen years; 7th. It does not occur in individual families.

## SHOEMAKERS' MEASURE.—

No. 1, small size, is 4½ inches, and every succeeding number increases ½ of an inch to 13.

No. 1, large size, is 8½ inches, and every succeeding number increases ½ of an inch to 15.

## SHRINKAGE OF CASTINGS.—

Tin—one-fourth inch in a foot.  
Zinc—five-sixteenths inch in a foot.  
Lead—five-sixteenths inch in a foot.  
Copper—three-sixteenths inch in a foot.  
Bismuth—five-thirty-seconds inch in a foot.  
Brass—two-fifteenths inch in a foot.  
Locomotive cylinders—½ inch in a foot.  
Pipes—one-eighth inch in a foot.  
Beams, girders, etc.—¼ inch in 15 inches.

## SICKNESS, RATIO OF.—

Drs. Farr and Edmondson, of the London Congress, are authorities for the following statements: 1st. The ratio of sickness rises and falls regularly with the death-rate in all countries; 2nd. Of 1000 persons, aged 30, it is probable 10 will die in a year, in which case there will be 20 of that age sick throughout the year, and 10 invalids. 3rd. Of 1000 persons, aged 75, it is probable 100 will die in a year, in which case the sick and invalids will be 300 throughout the year; 4th. For every 100 deaths let there be hospital beds for 200 sick, and infirmaries for 100 invalids.

**SNOW, WEIGHT OF.**—At various times it has been ascertained that snow weighs from 5 to 10½ lbs. per cubic foot, at a temperature of 32° (Fah.). The weight of snow seems to vary greatly in different latitudes—it being heavier as the latitude increases. The above weights were for Washington. In Canada it weighed 14½ lbs. on falling; twenty-four hours later, 2½ lbs.; and seventy-two hours later, 28½ lbs.

**SMOKING, COST OF.**—The expense of smoking three five-cent cigars a day, principal and interest, for ten years, is \$74.57; for 25 years, \$3,110.74. The expense of three ten-cent cigars, at the end of ten years, is \$1,471.56; for 25 years, \$6,322.47; for 50 years, \$54,162.14.

**SOLID OR CURB MEASURE.**—See Cubic Measure.

**SPECTRUM, SOLAR.**—While light from the sun in passing through a prism is decomposed into seven different colors, viz., red, orange, yellow, green, blue, indigo, and violet, in the order as given, the red being refracted least, and violet, most.

According to the Undulatory Theory, the color of light depends on the size of the minute waves that produce it. The undulations that excite in the eye the sensation of red light are each 5000 of an inch in breadth; those that produce violet, 5000; while the intermediate colors are produced by undulations varying between these limits.

**SPECIFIC HEAT.**—The quantity of heat termed specific heat, required to raise the temperature of a pound of water one degree is taken as unit. Substances requiring more or less heat than water, are said to be of higher or lower specific heat. Mercury requires

thirty times the quantity, and its specific heat is one thirtieth. Hydrogen requires three and a half times less heat, and its specific heat is expressed by three and a half.

**SPECIFIC GRAVITY, TABLES OF.**—Specific Gravity is the ratio of the weight of a body to that of an equal volume of some other substance adopted as a standard of reference. For solids and liquids the standard is distilled water at 62° F., the barometer being at 30 inches. Aeriform bodies are referred to the air, at 32° F., and under one atmospheric pressure.

A cubic foot of rain water weighs 1000 ounces (Avoir), and the following are tables of the relative weights of the principal substances. In all the tables, except that of Gases and Vapors, by removing the decimal point three places toward the right, that is, multiplying by 1000, the result will indicate the number of ounces (Avoir) in a cubic foot of the substance named. To find the number of pounds in a cubic foot, divide the ounces by 16.

## WOODS.

Name.	SPECIFIC GRAVITY.	Name.	SPECIFIC GRAVITY.
Acacia.....	.800	Larch, light.....	.500
Alder.....	.510	Larch, heavy.....	.560
Apple tree.....	.792	Lignum vite, light.....	.650
Ash, light.....	.700	Lignum vite, heavy.....	.830
Ash, heavy.....	.840	Locust.....	.710
Bamboo.....	.400	Logwood.....	.900
Bay Tree.....	.800	Lemon.....	.702
Beech, light.....	.690	Mahogany.....	1.063
Beech, heavy.....	.850	Maple, Cuban.....	.750
Birch.....	.711	Maple.....	.755
Blue gum.....	.843	Mora.....	.820
Box.....	.950	Oak, English.....	.930
Brazil wood, red.....	1.000	Oak, French.....	.700
Bull tree.....	1.048	Oak, light.....	.820
Cabacall.....	.900	Oak, Am., heavy.....	.760
Cane.....	.400	Oak, Baltic.....	.740
Cedar of Lebanon.....	.560	Oak, Ital., light.....	.960
Cedar, Amer.....	.480	Oak, Ital., heavy.....	1.040
Charcoal, birch.....	.540	Orange.....	.705
Charcoal, oak.....	.450	Pear.....	.661
Charcoal, pine.....	.230	Pine, pitch.....	.660
Cherry.....	.715	Pine, red.....	.640
Chestnut.....	.640	Pine, yellow.....	.520
Cork.....	.240	Poplar.....	.870
Cowrie.....	.579	Poplar, white.....	.510
Cypress.....	.598	Poplar, Italian.....	.420
Ebony, Indian.....	1.100	Poplar, yellow.....	.383
Ebony, Amer.....	1.280	Saul.....	.360
Elder.....	.670	Pruce.....	.480
Elm, light.....	.520	Sycamore.....	.600
Elm, heavy.....	.720	Teak, Indian.....	.780
Fig, Brazilian.....	.580	Teak, African.....	.960
Fig, Riga.....	.540	Tonka.....	.990
Hawthorn.....	.910	Walnut, Riga.....	.660
Hazel.....	.640	Walnut, Amer.....	.560
Holly.....	.760	Walnut, Span.....	.670
Hornbeam.....	.770	Walnut, white.....	.375
Juniper.....	.556	Watergum.....	1.000
Kauri or Cowdie.....	.530	Willow.....	.480
Laburnum.....	.320	Yew.....	.807

\* The specific gravities of woods differ according as they are from hills or plains, dry or green. Those given above are for woods having dried in the air for ten to twelve months, and lost from one-third to one-fourth of their weight.



# WEIGHT COEFFICIENT MEASURES U.S.

## SPECIFIC GRAVITY, CONTINUED.— STONES, EARTHS, SOLIDS, ETC.

NAME.	SPECIFIC GRAVITY.	NAME.	SPECIFIC GRAVITY.
Alabaster.....	1.774	Hemetite etc.....	4.507
Alum.....	1.724	Ivory.....	1.917
Amber.....	1.078	Jargon, Ceylon.....	4.416
Ambergris.....	.780	Kentish rag.....	2.660
Amethyst.....	2.750	Lard.....	.947
Asphalt, grt.....	2.500	Lime, chalk, grd.....	.830
Basalt.....	2.864	Limestone.....	2.500
Basthstone.....	1.370	Malachite.....	3.700
Bermuda stone.....	2.620	Marble, average.....	2.700
"    soft.....	1.470	Marl.....	1.900
Beryl, Oriental.....	2.545	Meersaut, table.....	2.200
Bismutem.....	1.000	"    ashlar, Port d.....	2.200
Borne, ox.....	1.054	"    granite.....	2.500
Brick, common.....	2.000	Mica.....	2.750
Brick, fire.....	2.400	Millstone.....	2.500
Brick-wall.....	1.800	Mortar, old.....	1.400
Butter.....	.947	Mortar, new.....	1.700
Caen stone.....	2.000	Mud.....	1.630
Cement, Portland.....	1.200	Nitre.....	1.900
Cement, Roman.....	.900	Opal.....	2.114
Chalk, solid.....	2.800-1.800	Opium.....	1.337
Clay, potshrs.....	1.900	Pearl.....	2.510
Clay with gravel.....	2.000	Peat, hard.....	1.300
Clay, ordinary.....	1.900	Pitch.....	1.100
Coal, anthracite.....	1.600	Plaster of Paris.....	2.100
Coal, bituminous.....	1.250	Porcelain, Chinese.....	2.385
Coke.....	.700	Porphyry, green.....	2.900
Concrete.....	1.900	Pumice stone.....	.910
Concrete, lime.....	1.800	Purbeck stone.....	2.600
Coral.....	2.680	Puzzolana.....	2.600
Crystall. rock.....	2.653	Quartz.....	2.640
Diamond.....	3.536	Rosin.....	1.100
Dolomite.....	2.540	Rothen stone.....	2.000
Earth, vegetable.....	1.400	Salt.....	2.130
Earth, loamy.....	1.600	Sand, river.....	1.900
Earth, semi fluid.....	1.700	Sardstone.....	2.300
Emerald.....	2.678	Shale.....	2.600
Emery.....	4.000	Shingle.....	1.500
Fat, of beef.....	.924	Slate.....	2.900
Feldspar.....	2.600	Slates, Cornish.....	2.500
Flint.....	2.594	Spar.....	2.594
Freestone.....	2.200	Stone, average.....	2.500
Glass, bottle.....	2.733	Sugar.....	1.600
Glass, green.....	2.642	Sulphur, fused.....	2.000
Glass, flint.....	2.760	Tallow.....	.941
Glass, plate.....	2.940	Tar.....	1.015
Glass, crown.....	2.530	Tiles, average.....	1.800
Granite.....	2.625	Topaz.....	3.800
Graphite.....	1.987	Trap.....	2.700
Gum Arabic.....	1.452	Wax.....	.897
Gunpowder.....	.900	White lead.....	3.160
Gypsum.....	2.280	Women's Living Body.....	.891

### GASES AND VAPORS.

NAME.	SPECIFIC GRAVITY.	NAME.	SPECIFIC GRAVITY.
Vapor of bromine.....	5.5400	Oxygen.....	1.1056
Chloroform.....	3.3000	Air.....	1.0000
Vapor of hyphen.....	4.6978	Nitrogen.....	0.9736
Acetic ether.....	3.0400	Carbonic acid.....	0.9674
Vapor of benzine.....	2.6943	Olefiat gas.....	0.8847
"    sulphur.....	2.5850	Gaseous steam.....	0.6220
Chlorine.....	2.4400	Ammoniacal gas.....	0.5884
Sulphurous acid.....	2.2470	Light carb. hyd.....	0.5527
Alcohol.....	1.16130	Coal gas.....	0.4391
Carbonic acid.....	1.5290	Hydrogen.....	0.0692

## LIQUIDS.

NAME.	SPECIFIC GRAVITY.	NAME.	SPECIFIC GRAVITY.
Mercury.....	13.596	Muriatic acid.....	1.200
Arsenic acid.....	3.391	Vinegar.....	1.010
Bromine.....	2.966	Tar.....	1.010
Sulphuric acid.....	1.840	Wvale oil.....	.920
Nitric acid.....	1.271	Olive oil.....	.915
Nitrous acid.....	1.550	Turpentine oil.....	.870
Chloroform.....	1.530	Potato oil.....	.880
Honey.....	1.456	Petroleum.....	.820
Water, Dead Sea.....	1.240	Naphtha.....	.850
Water, distilled.....	1.000	Ether, nitric.....	1.110
Water, sea.....	1.026	"    sulphurous.....	1.080
Acetic acid.....	1.008	"    nitrous.....	.890
Milk.....	1.032	"    acetic.....	.890
Wine, Bordeaux.....	.994	"    hydrochloric.....	.870
Wine, Burgundy.....	.991	"    sulphuric.....	.720
Linseed oil.....	.940	Alcohol, proof spir.....	.920
Cask oil.....	.970	"    pure.....	.790
Poppy oil.....	.930	Betizine.....	.850
Rape seed oil.....	.920	Wood spirit.....	.800

## CHEMICAL ELEMENTS.

NAME.	SYMBOL.	ATOMIC WEIGHT.	SPECIFIC GRAVITY.
Aluminium.....	Al	27.5	2.560
Barium.....	Ba	137.	4.000
Cadmium.....	Cd	112.	8.600
Caesium.....	Cs	133.	.....
Calcium.....	Ca	40.	1.580
Cerium.....	Ce	92.	.....
Chromium.....	Cr	52.4	7.300
Cobalt.....	Co	59.	7.700
Copper.....	Cu	63.5	8.960
Davyum.....	Da	150.7	.....
Didymium.....	Di	96.	.....
Erbium.....	Er	112.6	.....
Gallium.....	Ga	69.9	5.900
Glucium.....	Gl	9.4	2.100
Gold.....	Au	197.	12.000
Iodine.....	I	113.4	7.400
Iridium.....	Ir	198.	21.150
Iron.....	Fe	56.	7.790
Lanthanum.....	La	92.8	.....
Lead.....	Pb	207.	11.440
Lithium.....	Li	7.	.590
Magnesium.....	Mg	24.	1.750
Manganese.....	Mn	55.	6.500
Mercury.....	Hg	200.	13.560
Nickel.....	Ni	58.	8.600
Osmium.....	Os	195.2	.....
Palladium.....	Pd	106.6	11.600
Platinum.....	Pt	197.4	21.500
Potassium.....	K	39.1	805
Rhodium.....	Rh	104.4	11.000
Rubidium.....	Rb	85.4	1.520
Ruthenium.....	Ru	104.4	11.400
Silver.....	Ag	108.	10.500
Sodium.....	Na	23.	.972
Strontium.....	Sr	87.5	2.540
Thallium.....	Tl	203.6	11.910
Thorium.....	Th	231.	7.800
Yttrium.....	Y	61.7	.....
Zinc.....	Zn	65.	7.000

\*The weight of the atom of an element as compared with the weight of the atom of hydrogen, taken as a standard.

To find the proportional parts by weight of the elements of any substance whose chemical formula is known:

RULE.—Multiply together the equivalent and the exponent of each element of the compound; the product will be the proportion by weight of that element in the substance.

\*The metals are good conductors of heat and of electricity, and are characterized by a peculiar metallic lustre, so are electro-positive.

The non-metals are non-conductors of heat and of electricity, and are electro-negative.

The semi-metals resemble the metals in their physical properties (i.e., have the metallic lustre), and the non-metals in their chemical properties (i.e., their oxides are most frequently acid anhydrides).

## \* THE NON-METALS.

NAME.	SYMBOL.	ATOMIC WEIGHT.	SPECIFIC GRAVITY.
Boron.....	B	11.	1.410
Bromine.....	Br	80.	5.540
Carbon.....	C	12.	3.500
Chlorine.....	Cl	35.5	1.330
Fluorine.....	F	19.	1.320
Iodine.....	I	127.	4.940
Nitrogen.....	N	14.	.872
Oxygen.....	O	16.	1.105
Phosphorus.....	P	31.	2.000
Selenium.....	Se	79.4	4.300
Silicon.....	Si	28.	2.490
Sulphur.....	S	32.	2.050
Tellurium.....	Te	128.	6.020

## \* THE SEMI-METALS.

NAME.	SYMBOL.	ATOMIC WEIGHT.	SPECIFIC GRAVITY.
Antimony.....	Sb	122.	6.700
Arsenic.....	As	75.	3.700
Bismuth.....	Bi	210.	9.700
Hydrogen.....	H	1.	.069
Molybdenum.....	Mo	92.	8.600
Niobium.....	Nb	94.	.....
Tantalum.....	Ta	182.	10.780
Tin.....	Sn	118.	7.280
Titanium.....	Ti	50.	4.300
Tungsten.....	W	184.	17.400
Uranium.....	U	120.	18.400
Vanadium.....	V	51.3	.....
Zirconium.....	Zr	89.6.	4.150

## MISCELLANEOUS.

NAME.	SPECIFIC GRAVITY.	NAME.	SPECIFIC GRAVITY.
Blood, human.....	1.054	Iron, wrought.....	7.699
Brass.....	about 8.000	"    cast.....	7.207
Bronze.....	8.218	"    electro.....	7.965
Cider.....	1.018	Iron ore.....	4.300
Cobalt, cast.....	7.812	Lead ore.....	7.250
Copper, cast.....	8.768	Live oak.....	1.100
Copper coin.....	8.915	Mercury, solid.....	15.600
Filber.....	.600	Pewter.....	7.471
Gold, hammered.....	19.360	Silver, cast.....	10.474
"    coin.....	17.647	"    coin.....	10.534
"    trinket.....	15.609	Steel.....	7.816
Gun metal.....	8.784	Tin, cast.....	7.500
Human body living.....	.891	Type metal.....	10.400
Ice.....	.930	Zinc, cast.....	7.190

SQUARE OR SURFACE MEASURE.— See Land or Square Measure.

STAIR CASES, PROPER PROPORTION OF Treads and Risers.—

WIDTH OF TREAD.	HEIGHT OF RISER.	WIDTH OF TREAD.	HEIGHT OF RISER.
6 inches = 8 inches	10 inches = 6 inches	7 inches = 8 inches	11 inches = 6 inches
8 inches = 7 inches	12 inches = 5 inches	9 inches = 7 inches	13 inches = 5 inches

## STARCH, PERCENTAGE OF IN GRAINS.—

Rice flour, 85; Indian Corn meal, 78; Oatmeal, 75; Wheat flour, 39 to 71; Barley flour, 69; Rye flour, 50 to 61; Buckwheat, 52; Peas and Beans, 42; Potatoes, 13 to 15.

# WEIGHTS & MEASURES.

**STEAM, LATENT HEAT OF.**—Take two small vessels connected at the top by a tube. Let one contain 1 lb. of water at 32° Fahr., the other 5½ lbs. at the same temperature. Apply a spirit lamp below the vessel containing the 1 lb. of water until it is all boiled away, and its vapor condensed by passing through the tube and mingling with the 5½ lbs. of water in the other vessel. At this point the heat absorbed by the 5½ lbs. of water will raise the temperature to 212° Fahr., or boiling heat, and the combined weight will be 6½ lbs. instead of 5½ lbs., as placed in the vessel at first. The whole of this heat has been transferred from the 1 lb. of water held over the spirit lamp, although at no time has its heat exceeded 212°. Inasmuch as this heat cannot be measured by any known instrument, it is called latent heat. (See Latent Heat). The 1 lb. of water made the 5½ lbs. boil, and from this experiment we know by calculation that the combined sensible and latent heat of steam is 1200° Wm.

**STEAM, PRESSURE OF AT DIFFERENT DEGREES OF HEAT OF THE BOILER.**—At 212° of heat the water begins to boil, and at 868° the iron becomes of a red heat. 212° = a pressure of 15 pounds per sq. in. 251° = " 30 " " 294° = " 60 " " 347° = " 120 " " 398° = " 240 " " 464° = " 480 " " 568° = " 7,680 " "

## STEEL AND BRASS PLATES, WEIGHT OF

Per sq. ft. by American Gauge.			
No. of STEEL GAUGE, POUNDS.	BRASS POUNDS.	No. of STEEL GAUGE, POUNDS.	BRASS POUNDS.
1 10.993	12.382	18 1.531	1.725
2 9.789	11.027	19 1.363	1.536
3 8.718	9.819	20 1.214	1.367
4 7.763	8.744	21 1.081	1.218
5 6.913	7.787	22 .963	1.084
6 6.156	6.934	23 .857	.966
7 5.482	6.152	24 .763	.860
8 4.882	5.489	25 .680	.766
9 4.348	4.897	26 .603	.682
10 3.871	4.360	27 .539	.607
11 3.448	3.882	28 .481	.548
12 3.070	3.459	29 .427	.481
13 2.734	3.079	30 .380	.427
14 2.435	2.742	31 .339	.382
15 2.168	2.442	32 .302	.340
16 1.931	2.175	33 .269	.303
17 1.719	1.937	34 .239	.269

**SURVEYOR'S MEASURE.**—See Land or Square Measure.

**TEARING ASUNDER.**—The following shows the weight necessary to tear asunder bars one inch square of the following materials: Oak, 5½ tons; Fir, 5½ tons; Hickory, 6½ tons; Ash, 4½ tons; Sycamore, 4½ tons; Birch, 4½ tons; Pine, 3½ tons; Poplar, 3½ tons; Cast Iron, 7½ tons; Wrought Iron, 10 tons; Wrought Copper, 15 tons; English Bar Iron, 12½ tons; American Iron, 13½ tons; Blistered Steel, 5½ tons.

TEMPERATURES, TABLE OF. (Fahrenheit).	
Air furnace... 3308	Milk freeze... 29
Alumina coagulates... 145	Monkey, nat. tem. 104.5
Alcohol boils... 173.1	Mutton tallow melts 106
" " in vacuum 36	Naphtha boils 186
" does not freeze -20	Oil, lamp, melts 305
Animals hibernate 38	Olive oil freezes 50
Anise oil freezes... 50	Ox, nat. tem. 102
Antimony melts 960	Oyster, nat. tem. 82
Baking tempera- ture of oven 320-400	Phosphorus melts 111.5
Beef, nat. tem. 100	" inflames 120
Beef tallow melts 100	Pigeon, nat. tem. 103.5
Bismuth melts 520	Platinum melts 3080
Blood freezes... 30	Porpoise, nat. tem. 100
Boat in upper Egypt 138	Potassium melts 136
Brass melts... 1900	Protoxide of ni- trogen boils -157
Brine-salt, 0° freezes -4	Purification begins 50
Bromine melts... 95	" rapid 93
" freezes... -76	Rat, nat. tem. 102
" boils... 145.4	Rooms, best tem- perature for 65-68
Butter melts... 135	Rose oil freezes 60
Cadmium melts 600	Scalding heat 150
Carbonic acid freezes -148	Serpent, nat. tem. 88.5
" boils... -108.4	Shark, " 77
Cast iron melts 3500	Sheep, " 104.5
Cat, nat. tem. 102	Silk worm hatches 77
Chicken, nat. tem. 111	Silver melts 1850
Coffee and tea as usually drank 135	Snail, nat. tem. 76
Cold, lowest artificial -187	Sodium melts 204
Cold blooded animals die 106	Sparrow, nat. tem. 108
Common fire 1000	Sperm whale melts 112
Copper melts 2160	Starch, converted to sug- ar 160
Eggs in hatching 104	Steamboat's en- gine room, W.V. 111
Elephant, nat. tem. 99.5	Steak melts 155
Elk, nat. tem. 103	Steel melts 2462
Ether boils... 94.8	Sulphur melts 226
" freezes... 47	" ignites 360
Furnace of boilers 1100	Sulphuric acid boils 17.6
Glass melts... 2400	Tepid bath begins 86
Glow worm, nat. tem. 74	" ends 95
Gold melts... 1983	Tin melts... 451
Gutta percha melts 150	Turpentine freezes 51.5
Hog, nat. tem. 105	Vapor bath begins 130
Horse, nat. tem. 99.5	" ends 190
Ice melts... 32	" Finland 190
Iodine melts... 224.8	Warm bath begins 95
" boils... 347	" ends 99
Iron, bright red 752	Water, sea, boils 213.2
" white hot 2900	" fresh 212
Jackdaw, nat. tem. 107	" freezes 32
Lard melts... 96	" sea 27.4
Lead melts... 620	" boils in vacuum 72
Linseed oil boils 600	" " head Sea 223
Mercury melts 379	Wax melts... 155
Mercury freezes -40	Wine freezes... 20
" boils 662	Wrought iron melts 3912
" volatilizes 680	Zinc melts... 680
Milk boils... 199	

TEMPERATURE, BOILING POINTS OF	
Water at different Pressures. (Normal)	Boiling Point. Barometer.
° F.	° F.
184	16.676
190	18.992
195	21.124
200	23.454
205	25.468
210	28.744
211	29.331
212	29.922
213	30.516
214	31.120
215	31.730

TEMPERATURE, BOILING POINT OF	
Water at different Altitudes. (Normal)	Boiling Point. Barometer.
Places.	Above Sea Level.
Dunkirk (Himalaya)	7237 15.442
Mont Blanc	15650 16.956
Quito	9541 20.750
Madagascar	6290 22.905
Washington	1925 21.720
London	0 29.922
Dead Sea (below)	-1316 31.496

**TEMPERATURE, AT SUBTERRANEAN DEPTHS.**  
At 68 ft., 47.9° F.; at 299 ft., 48.8°; at 621 ft., 50.7°; at 939 ft., 52.6°; at 1290 ft., 58.3°; at 1414 ft., 59.4°; at 1662 ft., 61.2°; at 1900 ft., 61.4°

**TEMPERATURE, LUNAR.**—The temperature on the Moon during the night, which is a month long, is estimated to be 300° below zero (Fahr.), and during the day, which is also a month long, at 400° above zero.

**TEMPERATURE, INTERNAL OF THE EARTH.**—The increase in temperature is about 1° F. for every 45 feet of descent. At this rate the temperature at various depths is as follows:

Water will boil at a depth of 2,430 yds. Lead melts at a depth of 8,400 yds. There is red heat at a depth of 7 miles. Gold melts at a depth of 21 miles. Cast iron melts at a depth of 74 miles. Soft iron at 97 miles. — D.A. Wells.

**TEMPERATURE, WATERS OF SPRINGS.**  
Lebanon Springs, Columbia Co., N.Y. 75°  
Warm Springs, Bath Co., Va. 98°  
Sweet Springs, Monroe Co., W. Va. 99°  
Warm Springs, Meriwether Co., Ga. 90°  
Hot Springs, Garland Co., Ark. 157°  
Palmyra Springs, Jefferson Co., Wis. 72°  
Blankenship Springs, Texas Co., Mo. 75°  
St. Michael Springs, Azores Islands. 21°  
Hot Springs, Iceland 261°

**TEMPERATURE, EXTREME OF SUMMER.**—Bengal and Sahara Desert. 150°  
Senegal and Gaudalupe. 130°  
Persia, Calcutta, Central America. 125°  
Afghanistan and Arabian Desert. 110°  
Cape of Good Hope, Utah, Greece. 105°  
Arabia, Montreal, New York. 103°  
Spain, India, China, Jamaica. 100°  
France, Denmark, St. Petersburg. 90°  
Buenos Ayres, Sandwich Islands. 80°  
Great Britain, Siarn, Peru. 85°  
Siberia, Australia, Scotland. 75°  
Moscow, 65° Patagonia, 53° Iceland. 45°

**TEMPERATURE, EXTREME OF WINTER.**  
Boston, Mass. -13° Moscow, Russia -49°  
Chicago, Ill. -23° New York City -6°  
Denver, Col. -29° Poplar River, Mont. -62°  
Indianapolis, Ind. -25° Prescott, Ariz. -18°  
Jakovsk, Siberia -73° St. Petersburg, Rus. 51°  
La Crosse, Wis. -43° St. Vincent, Minn. -54°

**TEMPERATURE, IN POLAR REGIONS.**  
In the British expedition under Capt. Nares, with the two steamers Discoverer and Alert, to the Polar Sea, a sledge party advanced over the ice to latitude 83° 20' 26" N., but found no traces of human life beyond lat. 81° 52". In still weather the minimum temperature was more than 70° below zero, and not were the auroras brilliant and frequent occurrence during the intense darkness of the arctic night of 142 days.



# **THERMOMETER, COMPARISON BETWEEN**

Scales of Fahrenheit, Reaumur and Centigrade.

CENT. FAH.° RMR. CENT. FAH.° RMR.

1008.	212.8	= 80.0	25	= 77	= 20.
99	= 210	= 79.2	24	= 75.2	= 19.2
98	= 208.4	= 78.4	23	= 73.4	= 18.4
97	= 206.6	= 77.6	22	= 71.6	= 17.6
96	= 204.8	= 76.8	21	= 69.8	= 16.8
95	= 203	= 76	20	= 68	= 16
94	= 201.2	= 75.2	19	= 66.2	= 15.2
93	= 199.4	= 74.4	18	= 64.4	= 14.4
92	= 197.6	= 73.6	17	= 62.6	= 13.6
91	= 195.8	= 72.8	16	= 60.8	= 12.8
90	= 194	= 72	15	= 59	= 12
89	= 192.2	= 71.2	14	= 57.2	= 11.2
88	= 190.4	= 70.4	13	= 55.4	= 10.4
87	= 188.6	= 69.6	12	= 53.6	= 9.6
86	= 186.8	= 68.8	11	= 51.8	= 8.8
85	= 185	= 68	10	= 50	= 8
84	= 183.2	= 67.2	9	= 48.2	= 7.2
83	= 181.4	= 66.4	8	= 46.4	= 6.4
82	= 179.6	= 65.6	7	= 44.6	= 5.6
81	= 177.8	= 64.8	6	= 42.8	= 4.8
80	= 176	= 64	5	= 41	= 4
79	= 174.2	= 63.2	4	= 39.2	= 3.2
78	= 172.4	= 62.4	3	= 37.4	= 2.4
77	= 170.6	= 61.6	2	= 35.6	= 1.6
76	= 168.8	= 60.8	1	= 33.8	= .8
75	= 167	= 60	Zero	= 32	= Zero
74	= 165.2	= 59.2	1	= 30.2	= .8
73	= 163.4	= 58.4	2	= 28.4	= 1.6
72	= 161.6	= 57.6	3	= 26.6	= 2.4
71	= 159.8	= 56.8	4	= 24.8	= 3.2
70	= 158	= 56	5	= 23	= 4
69	= 156.2	= 55.2	6	= 21.2	= 4.8
68	= 154.4	= 54.4	7	= 19.4	= 5.6
67	= 152.6	= 53.6	8	= 17.6	= 6.4
66	= 150.8	= 52.8	9	= 15.8	= 7.2
65	= 149	= 52	10	= 14	= 8
64	= 147.2	= 51.2	11	= 12.2	= 8.8
63	= 145.4	= 50.4	12	= 10.4	= 9.6
62	= 143.6	= 49.6	13	= 8.6	= 10.4
61	= 141.8	= 48.8	14	= 6.8	= 11.2
60	= 140	= 48	15	= 5	= 12
59	= 138.2	= 47.2	16	= 3.2	= 12.8
58	= 136.4	= 46.4	17	= 1.4	= 13.6
57	= 134.6	= 45.6	18	= .2	= 14.4
56	= 132.8	= 44.8	19	= 2.2	= 15.2
55	= 131	= 44	20	= 4	= 16
54	= 129.2	= 43.2	21	= 5.8	= 16.8
53	= 127.4	= 42.4	22	= 7.6	= 17.6
52	= 125.6	= 41.6	23	= 9.3	= 18.4
51	= 123.8	= 40.8	24	= 11.2	= 19.2
50	= 122	= 40	25	= 13	= 20
49	= 120.2	= 39.2	26	= 14.8	= 20.8
48	= 118.4	= 38.4	27	= 16.6	= 21.6
47	= 116.6	= 37.6	28	= 18.4	= 22.4
46	= 114.8	= 36.8	29	= 20.2	= 23.2
45	= 113	= 36	30	= 22	= 24
44	= 111.2	= 35.2	31	= 23.8	= 24.8
43	= 109.4	= 34.4	32	= 25.6	= 25.6
42	= 107.6	= 33.6	33	= 27.4	= 26.4
41	= 105.8	= 32.8	34	= 29.2	= 27.2
40	= 104	= 32	35	= 31	= 28
39	= 102.2	= 31.2	36	= 32.8	= 28.8
38	= 100.4	= 30.4	37	= 34.6	= 29.6
37	= 98.6	= 29.6	38	= 36.4	= 30.4
36	= 96.8	= 28.8	39	= 38.2	= 31.2
35	= 95	= 28	40	= 40	= 32
34	= 93.2	= 27.2	41	= 41.8	= 32.8
33	= 91.4	= 26.4	42	= 43.6	= 33.6
32	= 89.6	= 25.6	43	= 45.4	= 34.4
31	= 87.8	= 24.8	44	= 47.2	= 35.2
30	= 86	= 24	45	= 49	= 36
29	= 84.2	= 23.2	46	= 50.8	= 36.8
28	= 82.4	= 22.4	47	= 52.6	= 37.6
27	= 80.6	= 21.6	48	= 54.4	= 38.4
26	= 78.8	= 20.8	49	= 56.2	= 39.2

## **WEIGHTS & CONTIN MEASURES U.S.**

**THERMOMETERS, NOTES ON.** - Freezing point  $32^{\circ}\text{F} = 0^{\circ}\text{C} = 0^{\circ}\text{R}$ ; Boiling point  $212^{\circ}\text{F} = 100^{\circ}\text{C} = 80^{\circ}\text{R}$ .

To convert degrees Centigrade or Reaumur into degrees Fahrenheit, or vice versa, use one of the following formulæ. - Let F = Number of degrees Fahrenheit, C = Number of degrees Centigrade, and R = Number of degrees Reaumur, hence -  
 $F = \frac{9}{5}C + 32$        $F = \frac{9}{4}R + 32$        $F = C + R + 32$ ,  
 $C = \frac{5}{9}(F - 32)$        $F = \frac{9}{4}R + 32$        $R = \frac{4}{9}(F - 32)$

**TEMPERATURE, TEMPERATURE NECES**  
 Sary low. (Moore). - The article being completed, is hardened by being heated gradually to a bright red, and then plunged into cold water: it is then tempered by being warmed gradually and equably, either over a fire, or on a piece of heated metal, till of the color corresponding to the purpose for which it is required, as per table below, when it is again plunged into water.

Corresponding Temperature.  
 A very pale straw.  $430^{\circ}\text{F}$  } Lancets.  
 Straw. .... 450 } Razors.  
 Darker straw .... 470 } Penknives, Scissors &c.  
 Yellow. .... 490 } Wood Tools.  
 Brown yellow. .... 500 } Hatchets, Saws, Chisels, &c.  
 Slightly tinged purple 520 } Cutting Chisels, and all  
 Purple. .... 530 } kinds of Percussive Tools.  
 Dark purple .... 550 } Springs.  
 Blue .... 570 }  
 Dark blue .... 600 } Soft for saws.

**TENACITY.** - A wire made of various metals, and 0.84 of a line in diameter, will sustain weights as follows.  
 Lead .... 28 lbs. Silver .... 187 lbs.  
 Tin .... 35 " Platinum .... 274 "  
 Zinc .... 110 " Copper .... 202 "  
 Gold .... 150 " Iron .... 549 "

## **TEMPERATURE, THERMOMETER.**

WATER. .... Health, Wealth  
 Milk and Water. .... Serenity of Mind.  
 Small Beer. .... Reputation, Happiness.  
 Cider and Perry. .... Cheerfulness, Contentment.  
 Wine. .... Strength, Vigor, Nourishment.  
 Porter. .... Merit - when taken at meals, and moderately.  
 Strong Beer. ....

## **FREEZING POINT.**

Vices.	Diseases.	Punishment.
Punch.	Idleness;	Sickness;
Toddy.	Pewishness;	Fucking;
Grog and Brandy.	Quarrelling;	Inflamed eyes;
Flip and Shrub.	Fighting.	Blacked face;
Bitters.	Lying.	Swollen legs;
Usquebaugh.	Sweating.	Lameness;
Hysterical Water.	Obscenity;	Burning in the hands, feet;
Gin.	Swindling.	Arrest;
Amisid Rum.	Perjury.	Dropsy;
Whiskey.	Burglary.	Epilepsy;
Whiskey.	Murder.	Melancholia;
Whiskey.	Whiskey.	Madness;
Whiskey.	Whiskey.	Palsy;
Whiskey.	Whiskey.	Apple eye;
Whiskey.	Whiskey.	Slate Prison;
Whiskey.	Whiskey.	GALLONS.

## **TIME AT WHICH MONEY DOUBLES AT**

Interest.

RATE PER CENT. SIMPLE INT. COMPOUND INT.

10	= 10 years.	7 years 100 days.
9	= 11 " 40 days.	8 " 16 "
8	= 12 " 180 "	9 " 2 "
7	= 14 " 104 "	10 " 89 "
6	= 16 " 240 "	11 " 327 "
5	= 20 " 0 " 15 "	75 "
4	= 25 " 81 " 15 "	273 "
3	= 33 " 0 " 17 "	246 "
2	= 50 " 208 " 20 "	54 "
1	= 100 " 33 " 120 "	23 " 164 "
1/2	= 200 " 40 " 0 " 28 "	26 "
1/4	= 400 " 50 " 0 " 35 "	1 "

## **TIME TABLE.**

60 seconds = 1 minute.  
 60 minutes = 1 hour.  
 24 hours = 1 day.  
 7 days = 1 week.  
 29 d. 12 h. 44 m. 3 s. = 1 lunar month.  
 28, 29, 30 or 31 days = 1 calendar month.  
 30 days = 1 interest month.  
 365 days = 1 common year.  
 365 1/4 days = 1 Julian year.  
 366 days = 1 leap year.  
 365 d. 5 h. 48 m. 48 s. = 1 solar or tropical year.  
 365 d. 6 h. 9 m. 12 s. = 1 sidereal year.  
 365 d. 6 h. 13 m. 48 s. = 1 anomalistic year.  
 88 days = 1 revolution of Mercury.  
 224 days = 1 " " " Venus.  
 365 days = 1 " " " Earth.  
 687 days = 1 " " " Mars.  
 4,332 days = 1 " " " Jupiter.  
 10,759 days = 1 " " " Saturn.  
 30,686 days = 1 " " " Uranus.  
 60,126 days = 1 " " " Neptune.  
 2 weeks = 1 fortnight.  
 4 weeks = 1 fortnight month.  
 52 weeks = 1 year, nearly.  
 12 months = 1 year.  
 13 months = 1 scholastic year.  
 12 lunar months = 1 Mohammedan year.  
 4 years = 1 olympiad.  
 10 years = 1 decade.  
 15 years = 1 Roman indiction.  
 19 years = 1 lunar cycle.  
 28 years = 1 solar cycle (Old Style).  
 100 years = 1 century.  
 500 years = 1 millennium.  
 1582 years = 1 Dionysian period (O.S.).  
 7600 years = 1 Dionysian period (N.S.).  
 7980 years = 1 Julian period.

## **TIME ON SHIPBOARD.** - (Whittaker). - For the purpose of discipline, and to fairly divide the watch, the crew is mustered in two divisions, the Starboard, and the Port. The day commences at noon, and is divided thus: - Afternoon Watch, from 4 P.M. to 8 P.M.; First Day Watch, 4 P.M. to 6 P.M.; Second Day Watch, 6 P.M. to 8 P.M.; First Watch, 8 P.M. to midnight; Middle Watch, 12 A.M. to 4 A.M.; Morning Watch, 4 A.M. to 8 A.M.; Forenoon Watch, 8 A.M. to noon.

Time is kept by "Bells".  
 Time A.M. 1 Bell = 6.30 Time P.M. 1 Bell = 6.30  
 1 Bell = 12.30 2 Bells = 7.00 1 Bell = 12.30 2 Bells = 7.00  
 2 Bells = 1.00 3 Bells = 7.30 2 Bells = 1.00 3 Bells = 7.30  
 3 " 1.30 4 " 8.00 3 " 1.30 4 " 8.00  
 4 " 2.00 4 " 8.30 4 " 2.00 4 " 8.30  
 5 " 2.30 Time A.M. 5 " 2.30 Time P.M. 5 " 2.30  
 6 " 3.00 1 Bell = 8.30 6 " 3.00 1 Bell = 8.30  
 7 " 3.30 2 Bells = 9.00 7 " 3.30 2 Bells = 9.00  
 8 " 4.00 3 " 9.30 8 " 4.00 3 " 9.30  
 9 " 4.30 4 " 10.00 9 " 4.30 4 " 10.00  
 1 Bell = 4.30 5 " 10.30 1 Bell = 4.30 5 " 10.30  
 2 Bells = 5.00 6 " 11.00 2 Bells = 5.00 6 " 11.00  
 3 " 5.30 7 " 11.30 3 " 5.30 7 " 11.30  
 4 " 6.00 8 " noon 4 " 6.00 8 " midnight.

## WEIGHTS & MEASURES.

### TISSUES, ETC., PROPORTION OF SALT IN 1000 PARTS.—

Muscles.....	2.0	Saliva.....	1.5
Bones.....	2.5	Bile.....	3.5
Cartilages.....	2.8	Blood.....	4.5
Milk.....	1.0	Mucus.....	0.6

### TORTION, RELATIVE POWER OF METALS

To Resist, Lead being 1.—			
Lead .....	1.0	Cast Iron.....	9.0
Tin .....	1.4	Swedish Iron..	9.5
Copper .....	4.3	English Iron...	10.1
Yellow Brass ...	4.6	Blistered Steel...	16.6
Gun Metal .....	5.0	Shear Steel.....	17.0

### TRANSPARENCY OF THE OCEAN.—

Experiments made by Capt. Wilkes indicate that light penetrates the ocean to the depth of 80 fathoms (480 ft.). The depth at which objects cease to be visible to the eye is much less. A pot painted white was let down into the water, and the point of invisibility marked; upon taking it out the point of visibility was marked, and the two were found to vary but a fathom or two. In water at 36° f., the pot disappeared at six fathoms; in water at 76° f., at thirty fathoms; in the Gulf Stream, at twenty-seven fathoms; just outside of it, at twenty-three fathoms.—D. A. Wells.

**TROY OR MINT WEIGHT.**—24 grains = 1 pennyweight; 20 pennyweights = 1 ounce; 12 ounces = 1 pound.

**TYPE, SIZES OF.**—All foundries cast their type one uniform height and depth, but the letters vary much in their breadth. The following are the sizes mostly used in books:

**Brilliant.**—A column 6 1/4 inches long, and 2 1/2 inches wide, if set in Brilliant, it would contain 124 lines, and about 7,500 letters.

Printing is the art of producing impressions from characters or types.

**Diamond** is the next size; the column, as above described, would contain 107 lines, and about 6,000 letters.

Printing is the art of producing impressions from disengaged type, 95 lines, 4,270 letters.

Printing is the art of producing impressions from disengaged type, 87 lines, 3,740 letters.

Printing is the art of producing impressions from disengaged type, 75 lines, 3,000 letters.

Printing is the art of producing impressions from disengaged type, 64 lines, 2,360 letters.

Printing is the art of producing impressions from disengaged type, 58 lines, 1,970 letters.

Printing is the art of producing impressions from disengaged type, 53 lines, 1,590 letters.

Printing is the art of producing impressions from disengaged type, 47 lines, 1,360 letters.

Printing is the art of producing impressions from disengaged type, 43 lines, 1,120 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

Printing is the art of producing impressions from disengaged type, 37 lines, 890 letters.

English, 34 lines, 680 letters.

## Printing is the art

Columbian, 30 lines, 550 letters.

## Printing is the art

Great Primer, 27 lines, 430 letters.

## Printing is the art

Double Pica, 22 lines, 280 letters.

## Printing is the art

### TYPE-SETTING, RATE OF.—

The rapidity with which type can be set depends upon the size of the type, and the character of the composition. An expert can set upward of 2000 ems, solid minion, 23 ems to the line, one break to each stick full, in an hour; or upward of 5000 ems, nonpareil, newspaper measure, in 3 hours.

**TYPEWRITING, RATE OF.—**The rapidity of this depends upon the character of the matter, and the familiarity of the writer with it. An expert can write, on ordinary correspondence, 100 words in a minute. Upward of 9000 words from dictation has been written in 1 hour 30 minutes.

**TYPE-PENWRITING, RATE OF.—**This term refers to the pen print as seen through out this book. In order to fairly represent this method with the above two, the writer timed his best work, and found that in ordinary work, such as this and the above two paragraphs, he could print a page of this book in four hours and ten minutes. The page contains about 4000 ems.

**Unit Measure.**—20 units = 1 score; 12 units = 1 dozen; 12 dozen = 1 gross; 12 gross = 1 great gross.

**UNITED STATES MONEY.**—10 mills = 1 cent; 10 cents = 1 dime; 10 dimes = 1 dollar; 10 dollars = 1 eagle.

**VENTILATION.**—Each person requires at least from 3 to 4 cubic feet of air per minute. Sleeping apartments require 1000 cubic feet of space to each occupant. An ordinary gas flame requires as much air as 9 persons.

### WHEAT OF SEEDS.—(See also Seeds.)

Wheat.....	3 1/2	Asparagus.....	3 1/2
Barley.....	3 1/2	Beet.....	3 1/2
Atchike.....	3 1/2	Muscard.....	3 1/2
Beans.....	2 1/2	Okra.....	3 1/2
Beets.....	3 1/2	Onions.....	2 1/2
Broccoli.....	5 1/2	Peas.....	5 1/2
Cabbage.....	3 1/2	Pumpkin.....	8 1/2
Caraway.....	2 1/2	Parsley.....	2 1/2
Cauliflower.....	5 1/2	Parsnip.....	1 1/2
Carrots.....	2 1/2	Pepper.....	2 1/2
Celery.....	2 1/2	Radish.....	3 1/2
Corn (on cob).....	2 1/2	Rhubarb.....	3 1/2
Cress.....	3 1/2	Sage.....	2 1/2
Cucumber.....	8 1/2	Squash.....	5 1/2
Endive.....	5 1/2	Spinach.....	3 1/2
Egg Plant.....	1 1/2	Sweet Corn.....	2 1/2
Leek.....	2 1/2	Tomato.....	3 1/2
Lettuce.....	3 1/2	Turnip.....	3 1/2
Melon.....	8 1/2	Wheat.....	2 1/2

### VOLUME AND WEIGHT OF DRY AIR.

The Standard of Comparison is the volume of air at 32° F., under an atmospheric pressure of 29.22 inches in the barometer.

TEMP. URE.	VOL. UME.	WEIGHT PER CUBE URE.	TEMP. ERAT.	VOL. UME.	WEIGHT PER CUBE URE.
0°	.935	.0864	162°	1.265	.0638
12	.960	.0842	172	1.285	.0628
22	.980	.0824	182	1.306	.0618
32	1.000	.0807	192	1.326	.0609
42	1.020	.0791	202	1.347	.0600
52	1.041	.0776	212	1.367	.0591
62	1.061	.0761	230	1.404	.0575
72	1.082	.0747	250	1.444	.0558
82	1.102	.0733	275	1.495	.0540
92	1.122	.0720	300	1.546	.0522
102	1.143	.0707	325	1.597	.0506
112	1.163	.0694	350	1.648	.0490
122	1.184	.0682	375	1.699	.0477
132	1.204	.0671	400	1.750	.0461
142	1.224	.0659	450	1.852	.0436
152	1.245	.0649	500	1.954	.0413

### WATER, WEIGHTS AND MEASURES OF.

FRESH. SALT.

Greatest density = 39.2° Fahr. = Freezing point. 1 cu. ft. at 40° = 62.425 lbs. = 63 lbs. 1 cu. in. at 40° = .036126 lbs. = .037037 lbs. 1 cu. in. at 40° = 7.500 grains = 1.464 grains. 1 gallon weighs = 8.33 lbs. = 8.61 lbs. 1 ton..... = 2400 gals. = 233 gals. Freezes..... = 32° Fahr. = 27° Fahr. Boils..... 212° Fahr. = 212° Fahr. 1 cubic foot of ice weighs 58.08 lbs. Water evaporates at all temperatures. In freezing it expands .076 of its bulk. By weight 88.889 parts = oxygen; 11.111 = hydrogen. By measure 1 part = oxygen; 2 = hydrogen. In changing to the gaseous state, water increases in volume 1696 times. About 34 part of the weight of sea water is salt.

### WATERFALLS, HEIGHT OF.— FEET.

Cerosola Cascade, Alps, Switzerland.....	2400
Falls of Arve, Switzerland.....	900
Lamberbaum, Lake Thun, Switzerland.....	600
Natchikinn Falls, Kamtschaka.....	300
Falls of Terni, near Rome.....	200
Mont Morency Falls, Quebec, Canada.....	250
Fryer's, near Lochness, Scotland.....	200
Niagara Falls, North America.....	164
Lidford Cascade, Devonshire, England.....	100
Sentinel, Yosemite Valley, California.....	3,270
Yosemite.....	2,634
Royal Arch.....	2,000
Getnesse Falls, Rochester, N.Y.....	96
Missouri Falls, Montana.....	94
Waterfall Mountain Cascade, S. Africa.....	85
Passaic Falls, New Jersey.....	78
Mohawk Falls, N.Y.....	60
Falls of St. Anthony, Upper Mississippi.....	60
Nile Cataracts, Upper Egypt.....	40
Tivoli Cascade, near Rome.....	40

### WATER, AMOUNT IN VARIOUS PARTS OF

The Body, in 1000 parts.—	
Teeth.....	100
Bones.....	130
Cartilage.....	550
Muscles.....	750
Ligaments.....	768
Brain.....	788
Blood.....	795

### WATER, VARIOUS TEMPERATURES OF.

Sea water is seldom below 40°; springs, about 45°; pools and small rivers are at the atmosphere; fountains, 57° to 77°; drying herbs, etc., 77° to 122°.



## WEIGHTS & CONTIN. MEASURES USED.

### WATER-POWER. TO CALCULATE.—

Niagara Falls has a capacity of more than ten millions of cubic feet per minute, equal to three million horse power nominal, or nine million real.

To calculate the power, in foot-pounds, or horse-power, of any water-fall, multiply the area of the cross section in feet by the velocity in feet per minute, and multiply by 62.4, the number of pounds in a cubic foot of water, and divide by the vertical fall in feet, which gives the number of foot-pounds per minute of the fall; divide by 33,000 to get the horse-power.

EXAMPLE.—The flume of a mill is 15 feet wide, the water is 4 feet deep, the velocity 50 feet per minute, and the fall 10 feet; what is the horse-power of the fall?  
Operation.—15 x 4 x 50 x 62.4 = 1,875,000. Then, 1,875,000 ÷ 33,000 = 56 2/3 horse-power.

**WATER, TEMPERATURE OF AT DIFFERENT PRESSURES.**—The temperature of boiling water at atmospheric pressure, or exposed to air, is 212°; under 60 lbs. pressure of steam as shown by steam gauge, 307°; usual heat of superheated steam, 380° to 400°.

**WATER, AMOUNT USED FOR DRINKING PURPOSES.**—Assuming that each individual drinks an average of one quart of water each day, during a life of 70 years, he would drink 203 barrels. The total population of the earth drink each year 1,875,655,900 hogsheads, equivalent to a lake having an area of 100 square miles, and 5 feet in depth.

**WAVES, SIZE AND FORCE OF.**—The dynamic force of waves is greatest at the crest of the wave before it breaks, and its power of raising itself is measured by various facts. At Vassburg, Norway it has risen 400 feet, and on the coast of Cornwall, 300 feet. There are cases showing that waves have sometimes raised columns of water equivalent to a pressure of from three to five tons per square foot.

The extreme height of mid-ocean waves is estimated to be from 20 to 22 ft., and the average force 611 lbs. per square foot during the summer months, and 2086 lbs. during the winter months.

By observation it has been determined that when waves had heights of

8 ft., there were 35 per mile, and 5 " 15 " " 3 " " 4 " 20 " " 3 " " 4 "

**WEEDS, NUMBER OF SEEDS OF.**—Dr. Lindley estimates as a low average the following number of seeds from each of these four plants:

1 plant of Groundsel produces	... 2,080
1 " Dandelion "	... 2,740
1 " Sow Thistle "	... 1,140
1 " Spurge "	... 540

The above estimates, the average of which is 4,100, may also be applied to pig-weed, burdock, fox-hall, chick-weed, and purslane.

The seed from the first four plants will cover three and a half acres of land at three feet apart.

### WEDDING ANNIVERSARIES.—

End of 1st year is the Golden Wedding.

" 2d "	" "	" "	" "	" "	" "
" 3d "	" "	" "	" "	" "	" "
" 5th "	" "	" "	" "	" "	" "
" 7th "	" "	" "	" "	" "	" "
" 10th "	" "	" "	" "	" "	" "
" 12th "	" "	" "	" "	" "	" "
" 15th "	" "	" "	" "	" "	" "
" 20th "	" "	" "	" "	" "	" "
" 25th "	" "	" "	" "	" "	" "
" 30th "	" "	" "	" "	" "	" "
" 40th "	" "	" "	" "	" "	" "
" 50th "	" "	" "	" "	" "	" "
" 75th "	" "	" "	" "	" "	" "

### WEIGHTS AND MEASURES, HISTORY OF.

The earliest units of linear measure were the finger, the thumb, the digit, the palm, the hand, the forearm (cubit), the fath-om (space from end of one arm to end of other, both arms being extended), the girdle, the foot, the span, the stride, the mile of 1000 paces, etc. Seeds were used as units both of weight and of length.

In 1266 it was enacted in England that "an English penny, called a sterling, round and without clipping, shall weigh 32 wheat corns, from the midst of the ear, and 20 pence shall make an ounce, and 12 oz. 1 pound, and 8 pounds do make a gallon of wine, and 8 gallons of wine do make a London bushel, which is the 8 part of a quarter; and in 1324, that "3 bar ley-corns, round and dry, shall make an inch" (meaning originally twelfth part), and 12 in. a foot." Other primitive standards of weight were the weight of a man, the load of a man, of an ass, but luck, mule, or camel.

Troy weight, supposed to be derived from the fair of Troyes, was used in England when, about the beginning of the 14th century, its foreign commerce began to enlarge.

Avoirdupois weight, now used for all merchandise sold by weight, except the precious metals and the precious stones, has been in use in England for many centuries. The word "avoirdupois" (to have weight) occurs first in the English statutes in 1335.

In the United States, Congress adopted the decimal system in the subdivision of money. In 1836 a law was enacted for regulating the Weights and Measures of the Union, by which the Secretary of the Treasury was directed to supply standards of weights, of length, and of capacity, according to the standards of Great Britain, to the Governors of States, and Revenue Collectors. John Quincy Adams reported in 1821 in favor of the British standards, because they were in general use, and a change to the decimal system (Metric System), would be attended with great embarrassment.

The Metric System was legalized in the United States on July 28, 1866.

**WHEAT, GRADES OF.**—Weight, color, and cleanliness are the principal considerations in determining the grade of wheat.

The word club is used in America and other countries to designate a kind or species of wheat, but in Liverpool it is used only to designate the best quality or the highest grade, and in that mark at any kind or species of wheat the quality of the grade is called Club Wheat.

In Liverpool the grades are Club and Av-

erage, and buyers are further guided by subdivisions of these grades.

GRADE. (1st Division)		2nd Division		Cleanliness	
No.	Name.	No.	Name.	No.	Weight.
Club	1 Choice.	1	63 lbs. Extra White.	1	Clean.
		1	63 lbs. White.	1	Clean.
	2 Common.	2	63 lbs. Light.	2	Clean.
		2	63 lbs. Dark.	2	Clean.
1 Choice.	1	2	63 lbs. Dark.	2	Mixed.
		3	60 lbs. Light.	3	Clean.
	2	4	60 lbs. Dark.	4	Clean.
		5	60 lbs. Dark.	5	Mixed.
2 Average.	1	1	60 lbs. Dark.	1	Mixed.
		2	57 1/2 lbs. Light.	2	Clean.
	2 Common.	3	57 1/2 lbs. Dark.	3	Clean.
		4	57 1/2 lbs. Dark.	4	Mixed.

### WHEAT, COMPOSITION OF.—Wheat

varies considerably as to the proportion of starch, gluten, etc., which it contains. One hundred parts of the grain of wheat contain on an average—water, 14.83; gluten, 19.64; albumen, 0.95; starch, 45.99; gum, 1.52; sugar, 1.50; oil, 0.87; vegetable fiber, 12.34; ash, 2.36; total, 100.00.

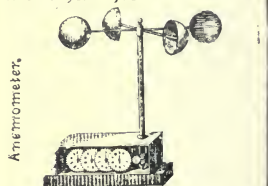
The ash is rich in phosphoric acid, magnesia, and potash. Its composition is as follows: Potash, 28.91; soda, 3.35; magnesia, 12.30; lime, 3.40; phosphoric acid, 46.00; sulphuric acid, 0.33; silica, 3.35; peroxide of iron, 0.79; chloride of sodium, 0.09; total, 100.00.

Of flour, the best wheat yields 76 to 80 per cent, sometimes even 86 per cent, whereas, inferior kinds seldom yield more than 68 per cent, and sometimes only 54 to 56 per cent.

Wheat-straw contains, on an average, nitrogenous substances, 1.85; non-nitrogenous substances, 67.56; mineral substances, 4.59; water, 26.00; total, 100.00. The ash of straw is as follows: Potash, 12.14; soda, 0.60; magnesia, 2.45; lime, 6.23; phosphoric acid, 5.43; sulphuric acid, 3.89; silica, 67.89; peroxide of iron, 0.74; chloride of sodium, 0.22; total, 100.00.

### WIND, VELOCITY OF. (See also Velocity.

Table.—Wind.—A body of air in motion is called wind. It travels at various rates and in many different directions. By means of an instrument called the anemometer (see cut), it has been ascertained that the velocity of a light wind is 5 miles an hour; of a "stiff breeze, 25 miles; of a storm, 50 or of a hurricane, from 80 to 100, or even 150, and of a cyclone, 180.



## WEIGHTS & MEASURES.

**WIND-MILLS, POWER OF AT DIFFERENT Velocities of the Wind.**—The length of an arm (whip) is divided into 7 parts, the sails extending over 6 parts. The force of the wind at 10 miles an hour, is half a pound per square foot; at 14 miles, 1 lb.; at 20 miles, 2 lbs.; at 25 miles, 3 lbs.; at 35 miles, 6 lbs.; at 45 miles, 10 lbs.; at 60 miles, 17½ lb.; at 100 miles, nearly 50 lbs.

The driving shaft of a wind-mill is to be set at an elevated angle with the horizon when set in low localities, and at a depressed angle when set on elevations. These angles may range from 30 to 35°. To give the fullest effect to the force of the wind, the sails are inclined to the axis from 72° to 75°. The tips of the sails often move 30 miles per hour, or 44 feet per second. From tip to tip is about 70 feet, and the breadth from 5 to 6 feet. The performance of such a mill is equivalent to the power of 34 men.

**WINE OR LIQUID MEASURE.**—4 gills = 1 pint; 2 pints = 1 quart; 4 quarts = 1 gallon; 3½ gallons = 1 barrel; 42 gallons = 1 tierce; 63 gallons = 1 hoghead; 2 hogheads = 1 pipe or butt; 2 pipes = 1 ton.

The wine gallon contains 231 cu. in. **WIRE, BARRED, AMOUNT REQUIRED FOR FENCES.**—The table is based upon each pound of wire measuring one rod (16½ feet).

Wire.	1 line.	2 lines.	3 lines.
1 square acre . . . . .	50½ lbs.	105 lbs.	152 lbs.
Side of a sq. acre . . . . .	12½ "	25½ "	38 "
1 square half-acre . . . . .	26 "	72 "	108 "
1 square mile . . . . .	1280 "	2560 "	3840 "
Side of sq. mile . . . . .	320 "	640 "	960 "
100 rods in length 100 "	200 "	200 "	300 "
100 feet " " "	6½ "	12½ "	18½ "

**WOOD-WORKING MACHINERY, SPEED OF.**—Circular saws for ripping soft wood, 9,000 ft. per minute at the periphery. Ripping hard wood, 6,000 ft. per minute at the periphery. Cross-cutting soft wood, 10,000 ft. per minute, and cross-cutting hard wood, 7,500 ft. per minute.

Mill or reciprocating saws, designed to carry not more than one saw per 1 in. width of saw or swing frame. To cut logs up to 4 ft. sq., 110 revs. per min.; 3 ft. 6 in. sq., 120 revs. per min.; 3 ft. sq., 125 revs. per min.; 2 ft. 6 in. sq., 135 revs. per min.; 2 ft. sq., 155 revs. per min.; 1 ft. 6 in. sq., 180 revs. per min.

Double Equilibrium Deal Sawing Frames (balance swing frames). To cut two deals up to 14 in. x 5 in., 300 revs. per min.; 18 in. x 6 in., 260 revs. per min.; 24 in. x 7 in., 220 revs. per min.

Single Deal Sawing Frames.—To cut one deal up to 11 in. x 3 in., 260 revs. per min.; 14 in. x 4 in., 250 revs. per min.; 18 in. x 6 in., 215 revs. per min.

Single-bladed Frames, 1,500 feet per min. Band Saws.—Blades running on wheels up to 3 ft. diameter. For sawing soft woods, Traverse of saw-blade per min. up to 4,500 ft.; on hard wood, 3,500 ft.; do. very hard wood, 1,000 ft.; do. 750 ft.; do. iron, 250 ft. Jigger Saws, to cut 12 in. deep, 80 to 1000 revs. per min.

**Planing Machines.**—The cutting edges of planing and molding irons—when two only are employed and arranged on cutter blocks varying in diameter from 4 in. to 3 in. in diameter—should be speeded to travel from 5,000 to 6,000 feet per minute.

**Mortising Machines (Reciprocating).**—Heavy machines to mortise up to 3 in. wide, 175 to 275 strokes per min. 1 in. wide, 200 to 300 strokes; 1 in. wide movable table, 275 to 400 strokes.

**Rotary Mortising and Boring Machines.**—Soft wood, 2,000 revs. per min.; hard wood, 1,200 per min.

**Tenoning Machines.**—Heavy machines, average 3,000 ft. of cutting edge per minute. Light machines, 3,000 to 4,000 ft. of cutting edge per minute.

Emery wheels for saw-sharpening, etc., 4,500 to 6,000 ft.

### WORDS, NUMBER USED BY DIFFERENT PERSONS.

Shakespeare, who had the richest vocabulary used by any Englishman, employed only 16,000 words. (There are upward of 60,000 different words in the English language.) Milton used but 8,000, and the average graduate from any of the great universities, rarely has a vocabulary of more than 3,000 or 4,000 words. The ordinary person can get along very comfortably with 500 words, and in the rural districts a knowledge of 200 words is sufficient to carry a man through his life. This of course refers to the needs of conversation. A man reading newspapers and well-written books, needs upward of 2,000 words. The Old Testament contains 5,642 different words.

### WORDS, TABLE SHOWING THE RELATIVE PROPORTION OF ANGLO-SAXON WORDS IN DIFFERENT DEPARTMENTS OF ENGLISH LITERATURE.

Words.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.
The English Bible . . . . .	93	100	100	100	100	100	100	100	100	100
The Prayer Book . . . . .	93	100	100	100	100	100	100	100	100	100
Poetry . . . . .	88	100	100	100	100	100	100	100	100	100
Prose Fiction . . . . .	87	100	100	100	100	100	100	100	100	100
Essays . . . . .	78	100	100	100	100	100	100	100	100	100
Rhetoric . . . . .	69	100	100	100	100	100	100	100	100	100

### WORDS, PROPORTION OF FOREIGN IN THE ENGLISH LANGUAGE.

From an examination of the dictionary, Dean Trench comes to the following conclusion: Suppose the English language to be divided into 100 parts; of these, to make a rough distribution, 60 are Anglo-Saxon; 20 are Latin; 5 are Greek; and the remaining 5 parts are to be divided among all the other languages from which isolated words have been derived.

### WINTER AND SUMMER TEMPERATURE.

The average difference between winter and summer temperature varies with the distance from the equator. At Singapore it is but 2°; at Bombay the difference is 6°; at Calcutta, 14°; at London, 23°; at St. Petersburg, 43°; at Quebec, 54°; New York, 44°; Bismarck, N.D., 63°; San Diego, Cal., 13°; Indianapolis, 48°; Chicago, 48°; Denver, 45°.

## MISCELLANEOUS WEIGHTS AND MEASURES.

Apples, green, bushel = 50 lbs.; barrel = 200 lbs. Almonds, seton = 1 to 2 cwt. Ashes, pot or pearl, barrel = 450 lbs. Beef, pork, or Bacon, hoghead = 1,000 lbs. Butter, bl., = 22½ lbs.; firkin = 56 lbs.; tub = 84 lbs. Cord = 2,000 lbs. Beer, hoghead = 54 gallons. Brandy, puncheon = 120 gals; hhd. = 60 gals.

Bricks, common, each = 5 lbs. Cement, barrel = 300 lbs. Charcoal, bushel = 22 lbs. Claret, hoghead = 46 gallons. Coffee, tierce = 5 to 6 cwt.; bag, Rio = 162 lbs.; St. Domingo = 130 lbs.; packet, Java = 50 lbs.; bale, Mocra, = 2 to 2½ cwt. Coke, bushel = 40 lbs. Cotton, bale = 300 to 400 lbs. Eggs, barrel = 200 lbs. Fathom = 6 feet. Figs, drum = 24 lbs. Fish, quintal = 112 lbs.; barrel = 200 lbs. Flax, Russian bale = 5 to 6 cwt. Flour, barrel = 196 lbs. Fodder of Lead = 19½ cwt. Ginger, ground, box = 24 lbs. Hair's Breadth = ¼ of an inch. Hand = 4 inches. Hides, green, each = 85 lbs.; dry, average = 33 lbs.

Honey, gallon = 12 lbs. Hops, bag = about 2½ cwt. Ice, bushel = 80 lbs. Indian Meal, hoghead = 800 lbs. Lard, barrel = 333 lbs. Last = 10 quarters of corn. Lemons, box, Sicily = about 300 lbs. Lime, barrel = 225 lbs. Line = ¼ of an inch. Mace, case = about 1½ cwt. Madeira, pipe = 32 gallons. Man's Load = 5 bushels. Market Load = 40 bushels. Metre = 3.28 feet. Nail = 2½ inches. Nails, keg = 100 lbs. Oranges, box, double O = 300 to 350 lbs. " " single O = 175 to 350 "

Oysters, bushel = 100 lbs. Pace = 3 feet. Palm = 3 inches. Pork, barrel = 200 lbs.; hoghead = 1,000 lbs. Port Wine, pipe = 115 gallons. Resin, barrel = 300 lbs. Rum, puncheon = 100 to 110 gallons. Powder, keg = 25 lbs. Raisins, cask = 100 lbs. Salma of Oil = 42.16 gallons. Salmon, box = 120 to 130 lbs. Salt, hoghead = 30 bushels; barrel = 3½ bushels; bushel = 70 lbs. Sand, Gravel, etc., cubic foot = 150 lbs. Sherry, butt = 108 gallons. Shipboard, Goldenberg = 300 lbs. Soap, barrel = 256 lbs.; box = 75 lbs. Span = 9 inches. Stone, dressed, cubic foot = 180 lbs. Straw or Hay, load = 36 truss. Sugar, barrel = 200 to 250 lbs.; box = 400 to 500 lbs.

Tallow, barrel = 333 lbs. Tat, barrel = 300 lbs. Tea, chest, Congou, = 75 lbs.; Hyson, chest = 100 to 84 lbs. Terrific, pipe = 100 gallons. Tonn of Wood = 2 stones. Truss of Hay = 56 to 60 lbs. " " Straw = 40 lbs. Turpentine, barrel = 300 lbs. Vata, Spanish, = 8 feet. " of Baracca = 20 feet. Whale Oil, barrel = 3½ gallons. Whiskey, Scotch, puncheon 110 to 120 gals. Wood, hickory, cord = 4,500 lbs. " " " = 3,500 lbs. " " oak = 240 lbs. " " " = 308 lbs. Yard = 0.914835 metre. Yarn, skein = 80 turns around a 54-in. wheel.



# WHO? WHAT? WHERE? WHEN?

[illegible]










[illegible]



[illegible]



NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN
	HIPPARCHUS-GREEK ASTRONOMER-B.C. 140			JOHN XIII.-ROM. PONTIFF-1572			JOHN XIV.-1572							
BEN JONSON.	HIPPOCRATES-GREEK PHYSICIAN-B.C. 460		LOUIS XIII.	JOHN XV.-1582			JOHN XVI.-1582							
HASTINGS, WARREN-VICEROY OF INDIA-1722	HOBBS, THOS.-ENG. PHILOSOPHER-1588		ISOCORATES-GREEK ORATOR-B.C. 430	JOHN XVII.-1582			JOHN XVIII.-1582							
HAVELOCK, HENRY-ENG. GENERAL-1795	HODGE, LAZARE-FR. GENERAL-1769		ISOTURBIDE, AGUSTIN-MEX. EMPEROR-1784	JOHN XIX.-1582			JOHN XX.-1582							
HAWTHORNE, NATHAN-AM. AUTHOR-1804	HODGE, JAS.-SCOT. POET-1697		IVAN II.-RUS. EMPEROR-1439	JOHN XXI.-1582			JOHN XXII.-1582							
HAYDON, JOS.-GER. COMPOSER-1732	HOLLIS, JAMES-GER. PAINTER-1437		IVAN IV.-1582	JOHN XXIII.-1582			JOHN XXIV.-1582							
HAYES, ISAAC-AM. ANOT. EXPLORER-1832	HOLLAND, J.-AM. POET-1819		JACOB, FR. EDWARD-GER. PHILOS.-1743	JOHN XXV.-1582			JOHN XXVI.-1582							
HAYES, B.-19TH PRES. OF U.S.-1828	HOLMES, OLIVER-W. AM. AUTHOR-1809		JACQUARD, JOS. M.-FR. INVENTOR-1752	JOHN XXVII.-1582			JOHN XXVIII.-1582							
HAYNE, ROBT. V.-AM. STATESMAN-1791	HOMER-GREEK POET-F.L. B.C. 875		JAMES I.-KING OF SCOTLAND-1394	JOHN XXIX.-1582			JOHN XXX.-1582							
HEGEL, GEORGE W.-GER. PHILOSOPH-1770	HOMERUS-FLAVIUS-ROM. EMPE. 364		JAMES II.-1582	JOHN XXXI.-1582			JOHN XXXII.-1582							
HEINE, HEINRICH-GER. POET-1799	HOSMER, HARRIET-AM. SCULPTOR-1830		JAMES III.-1582	JOHN XXXIII.-1582			JOHN XXXIV.-1582							
HEIMHOLTZ, H.-GER. PHYSICIST-1821	HOUSTON, SAM-AM. GENERAL-1793		JAMES IV.-1582	JOHN XXXV.-1582			JOHN XXXVI.-1582							
HEMANS, FELIX D.-ENG. POETESS-1749	HOWARD, JOHN-ENG. PHILANTH-1726		JAMES V.-1582	JOHN XXXVII.-1582			JOHN XXXVIII.-1582							
HENDRICKS, THOS.-AM. STATUARY-1819			JAMES VI.-1582	JOHN XXXIX.-1582			JOHN XXXX.-1582							
HENRY I.-KING OF FRANCE-1005			JAMES VII.-1582	JOHN XXXXI.-1582			JOHN XXXXII.-1582							
HENRY II.-1519			JAMES VIII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIV.-1582							
HENRY III.-1551			JAMES IX.-1582	JOHN XXXXV.-1582			JOHN XXXXVI.-1582							
HENRY IV.-1553			JAMES X.-1582	JOHN XXXXVII.-1582			JOHN XXXXVIII.-1582							
HENRY V.-1572			JAMES XI.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY VI.-1572			JAMES XII.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY VII.-1572			JAMES XIII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY VIII.-1572			JAMES XIV.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY IX.-1572			JAMES XV.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY X.-1572			JAMES XVI.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY XI.-1572			JAMES XVII.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY XII.-1572			JAMES XVIII.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY XIII.-1572			JAMES XIX.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY XIV.-1572			JAMES XX.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY XV.-1572			JAMES XXI.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY XVI.-1572			JAMES XXII.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY XVII.-1572			JAMES XXIII.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY XVIII.-1572			JAMES XXIV.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY XIX.-1572			JAMES XXV.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY XX.-1572			JAMES XXVI.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY XXI.-1572			JAMES XXVII.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY XXII.-1572			JAMES XXVIII.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY XXIII.-1572			JAMES XXIX.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY XXIV.-1572			JAMES XXX.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY XXV.-1572			JAMES XXXI.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY XXVI.-1572			JAMES XXXII.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY XXVII.-1572			JAMES XXXIII.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY XXVIII.-1572			JAMES XXXIV.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY XXIX.-1572			JAMES XXXV.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY XXX.-1572			JAMES XXXVI.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY XXXI.-1572			JAMES XXXVII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY XXXII.-1572			JAMES XXXVIII.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY XXXIII.-1572			JAMES XXXIX.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY XXXIV.-1572			JAMES XL.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY XXXV.-1572			JAMES XLI.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY XXXVI.-1572			JAMES XLII.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY XXXVII.-1572			JAMES XLIII.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY XXXVIII.-1572			JAMES XLIV.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY XXXIX.-1572			JAMES XLV.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY XL.-1572			JAMES XLVI.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY XLI.-1572			JAMES XLVII.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY XLII.-1572			JAMES XLVIII.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY XLIII.-1572			JAMES XLIX.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY XLIV.-1572			JAMES L.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY XLV.-1572			JAMES LI.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY XLVI.-1572			JAMES LII.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY XLVII.-1572			JAMES LIII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY XLVIII.-1572			JAMES LIV.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY XLIX.-1572			JAMES LV.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY L.-1572			JAMES LVI.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LI.-1572			JAMES LVII.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LII.-1572			JAMES LVIII.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LIII.-1572			JAMES LIX.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LIV.-1572			JAMES LX.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LV.-1572			JAMES LXI.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LVI.-1572			JAMES LXII.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LVII.-1572			JAMES LXIII.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY LVIII.-1572			JAMES LXIV.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LIX.-1572			JAMES LXV.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LX.-1572			JAMES LXVI.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LXI.-1572			JAMES LXVII.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LXII.-1572			JAMES LXVIII.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LXIII.-1572			JAMES LXIX.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LXIV.-1572			JAMES LXX.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LXV.-1572			JAMES LXXI.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY LXVI.-1572			JAMES LXXII.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LXVII.-1572			JAMES LXXIII.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LXVIII.-1572			JAMES LXXIV.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LXIX.-1572			JAMES LXXV.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LXX.-1572			JAMES LXXVI.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LXXI.-1572			JAMES LXXVII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LXXII.-1572			JAMES LXXVIII.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LXXIII.-1572			JAMES LXXIX.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY LXXIV.-1572			JAMES LXXX.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LXXV.-1572			JAMES LXXXI.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LXXVI.-1572			JAMES LXXXII.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LXXVII.-1572			JAMES LXXXIII.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LXXVIII.-1572			JAMES LXXXIV.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LXXIX.-1572			JAMES LXXXV.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LXXX.-1572			JAMES LXXXVI.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LXXXI.-1572			JAMES LXXXVII.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY LXXXII.-1572			JAMES LXXXVIII.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LXXXIII.-1572			JAMES LXXXIX.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LXXXIV.-1572			JAMES LXXX.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LXXXV.-1572			JAMES LXXXI.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LXXXVI.-1572			JAMES LXXXII.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LXXXVII.-1572			JAMES LXXXIII.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LXXXVIII.-1572			JAMES LXXXIV.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LXXXIX.-1572			JAMES LXXXV.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							
HENRY LXXXX.-1572			JAMES LXXXVI.-1582	JOHN XXXXVI.-1582			JOHN XXXXVI.-1582							
HENRY LXXXXI.-1572			JAMES LXXXVII.-1582	JOHN XXXXVII.-1582			JOHN XXXXVII.-1582							
HENRY LXXXXII.-1572			JAMES LXXXVIII.-1582	JOHN XXXXVIII.-1582			JOHN XXXXVIII.-1582							
HENRY LXXXXIII.-1572			JAMES LXXXIX.-1582	JOHN XXXXIX.-1582			JOHN XXXXIX.-1582							
HENRY LXXXXIV.-1572			JAMES LXXXX.-1582	JOHN XXXXII.-1582			JOHN XXXXII.-1582							
HENRY LXXXXV.-1572			JAMES LXXXXI.-1582	JOHN XXXXIII.-1582			JOHN XXXXIII.-1582							
HENRY LXXXXVI.-1572			JAMES LXXXXII.-1582	JOHN XXXXIV.-1582			JOHN XXXXIV.-1582							
HENRY LXXXXVII.-1572			JAMES LXXXXIII.-1582	JOHN XXXXV.-1582			JOHN XXXXV.-1582							

NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN	NAME	OCCUPATION	BORN
LEO V. ROM. PONTIFF	903		MAHMOUD	SULTAN OF TURKEY	1696	MORE, HANNAH	ENG. AUTHORESS	1745	MORE, SIR THOMAS	ENG. STATESMAN	1480	MOREAU, JEAN-FR.	GEN. GENERAL	1733
LEO VII	904	939	MAHMOUD II	1795		MORGAN, JAMES	CONFED. GENERAL	1825	MORGAN, JOHN	ENG. STATESMAN	1838	MORRIS, GEORGE	AM. JOURNALIST	1802
LEO VIII	905	965	MAINTENON, FRANÇOISE	WF. LOUIS XIV.	1635	MORRIS, ROBERT	AM. FINANCIER	1734	MORSE, D.D.	AM. INVENTOR OF TELEGRAPH	1791	MORTON, JAMES	SCOT. RECENT	1530
LEO IX	906	1054	MALIBRAND, MARIA-FR.	VOCALIST	1808	MORSE, HENRY	AM. STATESMAN	1823	MORTON, ALAN	AM. HISTORIAN	1814	MULLER, MAX	ENG. PHILOLOGIST	1756
LEO X	907	1521	MALPICA, MARCELLO	ITAL. SURGEON	1628	MORSE, HENRY	LAW-DIVER	B.C. 170	MULLER, MAX	ENG. PHILOLOGIST	1756	MURRAY, JAMES	SCOT. RECENT	1530
LEO XI	908	1685	MALPICA, MARCELLO	ITAL. SURGEON	1628	MORTON, ALAN	AM. HISTORIAN	1814	MURRAY, JAMES	SCOT. RECENT	1530			
LEO XII	909	1760	MALPICA, MARCELLO	ITAL. SURGEON	1628	MORTON, ALAN	AM. HISTORIAN	1814						
LEO XIII	910	1810	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEONIDAS	GEN. OF SPARTA	B.C. 480	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEONIDAS	I-GER. EMPEROR	1640	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD I	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD II	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD III	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD IV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD V	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD VI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD VII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD VIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD IX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD X	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XXXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XL	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD XLIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD L	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LVIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXIX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXX	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXIV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXV	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXVI	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXVII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXVIII	1740	1747	MALPICA, MARCELLO	ITAL. SURGEON	1628									
LEOPOLD LXXXXXIX	1740	1747	MALPICA, MARCELLO											



[illegible]







# GEOGRAPHY OF THE HEAVENS

## DESCRIPTION OF THE MAPS.

THE MAP OF THE NORTHERN HEMISPHERE REPRESENTS THE CONCAVE SURFACE OF THE NORTHERN HALF OF THE HEAVENS, AND THE SOUTHERN HEMISPHERE THAT OF THE SOUTHERN. THE CELESTIAL EQUATOR OR EQUINOCTIAL IS REPRESENTED ON THE MAP BY THE LARGE CIRCLE AROUND THE MARGIN. IT IS TO THE HEAVENS WHAT THE EARTH'S EQUATOR IS TO THE EARTH. THE LINES RUNNING PARALLEL TO IT AND ENCIRCLING THE POLES ARE CALLED PARALLELS OF DECLINATION. THEY CORRESPOND TO THE PARALLELS OF LATITUDE ON THE EARTH. THE LINES DRAWN FROM THE EQUINOCTIAL TO THE POLES AT INTERVALS OF 15° ARE CALLED MERIDIANS OF RIGHT ASCENSION. OF RIGHT ASCENSION OF SUN, MOON, OR PLANETS. THEY CORRESPOND TO THE MERIDIANS OF LONGITUDE ON THE EARTH. DECLINATION IS THE DISTANCE OF A HEAVENLY BODY IN DEGREES, MINUTES, AND SECONDS, EITHER NORTH OR SOUTH OF THE EQUINOCTIAL, MEASURED ON A MERIDIAN EXTENDING TO THE RIGHT FROM EACH POLE. RIGHT ASCENSION IS THE DISTANCE OF A HEAVENLY BODY, IN HOURS, MINUTES AND SECONDS, EAST FROM THE FIRST POINT OF ARIES, MEASURED ON THE EQUINOCTIAL. (SEE THE INTERSECTION OF THE ECLIPIC AND EQUINOCTIAL AT THE RIGHT MARGIN OF EACH MAP.) THE ECCENTRIC IS THE APPARENT ANNUAL PATH OF THE SUN AMONGST THE STARS. ITS APPARENT MOTION IN ITS PATH IS FROM THE WEST TOWARD THE EAST, AND THE ENTIRE CIRCUIT OF THE HEAVENS IS COMPLETED IN A YEAR. THE POSITION OF THE SUN AMONGST THE STARS IS SHOWN ON THE ECLIPIC FOR DIFFERENT PERIODS IN THE YEAR.

## NORTHERN HEMISPHERE.

## THE GREEK ALPHABET USED IN NAMING THE STARS.

Α, ALPHA; Β, BETA; Γ, GAMMA; Δ, DELTA; Ε, EPSILON; Ζ, ZETA; Η, ETA; Θ, THETA; Ι, IOTA; Κ, KAPPA; Λ, LAMB; Μ, MU; Ν, NU; Ξ, XI; Ο, OMICRON; Π, PI; Ρ, RHO; Σ, SIGMA; Τ, TAU; Υ, Upsilon; Φ, PHI; Χ, CHI; Ψ, PSI; Ω, OMEGA.

## THE CONSTELLATIONS.

TO FIND ANY CONSTELLATION ON THE MAPS, LOOK IN THE LIST BELOW FOR THE DECLINATION AND RIGHT ASCENSION. IF THE DECLINATION BE NORTH (INDICATED BY N), LOOK IN THE NORTHERN HEMISPHERE; IF SOUTH, IN THE SOUTHERN. THEN RULES 18-19 NORTH OR SOUTH OF THE EQUINOCTIAL. TO FIND ANY CONSTELLATION IN THE SKY, HOLD THE MAP (NORTH OR SOUTH) TO A LINE FROM THE EYE AND THE POLE STAR, AND THEN TURN IT AROUND TILL THE CONSTELLATIONS ON THE MAP CORRESPOND TO THOSE IN THE HEAVENS.

## THE DIPPER.

THE DIPPER IS A GROUP OF STARS IN URSA MAJOR, AT THE DIFFERENT SEASONS OF THE YEAR.

## NAMES OF THE CONSTELLATIONS WITH THEIR LOCATION ON THE CELESTIAL CHART SHOWN.

NAMES OF CONSTELLATIONS.	DECLIN. NORTH.	RIGHT ASCEN.	NAMES OF CONSTELLATIONS.	DECLIN. NORTH.	RIGHT ASCEN.	NAMES OF CONSTELLATIONS.	DECLIN. NORTH.	RIGHT ASCEN.	NAMES OF CONSTELLATIONS.	DECLIN. NORTH.	RIGHT ASCEN.
ANDROMEDA.....	30N	1	CAMELEON.....	75S	10	MERCURUS.....	30N	17	NAVIS ARGO.....	45S	9
ANTINUS.....	2N	20	COELA SCALPTORIS.....	35S	5	HOROLOGIUM.....	48S	3	NORMA.....	45S	16
ANTILIA TYPHOPHORE.....	45S	0	COLUMBA.....	35S	6	HYDRA.....	4N	9	NUBECULA MAJOR.....	70S	5
APPARATUS SCULPTORIS.....	74S	0	COMA BERENICES.....	22N	13	HYDRUS.....	75S	3	NUBECULA MINOR.....	75S	2
AQUARIUS.....	2N	21	CORONA AUSTRALIS.....	40S	19	INDUS.....	60S	21	OCTANS.....	85S	17
AQUILA.....	15N	19	CORONA BOREALIS.....	70N	16	LACERTA.....	45N	22	OPHIUCHUS.....	5N	17
ARA.....	50S	17	CORVUS.....	15S	19	LEPUS.....	24S	5	ORION.....	8N	6
ARIES.....	29N	2	CRATER.....	15S	11	LEO.....	15N	11	PAVO.....	70S	19
AURIGA.....	38N	4	CRUX.....	60S	12	LEO MINOR.....	30N	10	PEGASUS.....	30N	22
AVIS PARADISA.....	75S	16	CYGNUS MESSIUM.....	70N	2	LIBRA.....	2N	15	PERSEUS.....	45N	3
BOOTES.....	30N	14	CYGNUS.....	45N	20	LINEA NAUTICA.....	30S	9	PHOENIX.....	45S	1
CANCER.....	15N	8	DELPHINUS.....	15N	21	LUPUS.....	45S	15	PISCES.....	15N	11
CENSAURUS.....	75N	0	ECUADOR.....	45N	13	LYRA.....	45N	19	PISCIS VOLANS.....	30S	25
CANNES VENATORIS.....	45N	45	DRACO.....	60N	17	LYRA.....	40N	19	TRIANGULUM AUSTRALIS.....	70S	8
CANIS MAJOR.....	20S	7	EQUELUS PICTORIUS.....	50S	6	MACHINA ELECTRICA.....	70S	2	TRIANGULUM MINUS.....	2N	4
CANIS MINOR.....	8N	8	ERIDANUS.....	2N	4	MACHINA PNEUMATICA.....	15S	10	TRIANGULUM MAJUS.....	30N	2
CAPRICORNUS.....	15S	21	FELIS.....	15S	10	MEROSOPHUM.....	40S	21	URANIE, SEXTANS.....	65S	9
CAPRUS.....	35N	4	FONATZ CHEMICA.....	30S	8	MONOCEROS.....	4N	7	URANIE, SEXTANS.....	50N	15
CASSIOPEIA.....	60N	6	GEMINI.....	15N	7	MONS MENSA.....	10N	14	URSA MINOR.....	75S	16
CENTAURUS.....	45S	13	GLOBUS AEROSTATICUS.....	30S	21	MONS MENSA.....	75S	6	VIRGO.....	5N	18
CEPHUS.....	65N	22	GLORIA FREDERICI.....	45N	23	MUSCA AUSTRALIS.....	70S	13	VIRGO.....	55S	13
CETUS.....	8N	3	GRUS.....	45S	22	MUSCA BOREALIS.....	30N	3	VULPECULA ET ANSER.....	25N	20

ORIGINAL COPY BY THE AUTHOR



# TABLE OF VELOCITIES.



The velocities given in the following list have been compiled from various authorities, and while it cannot be said what the possibilities of many of the moving bodies are, such as steam vessels, locomotives, etc., yet the figures given will convey a general idea of possibilities. The slow coach of the time of Washington will not compare with the lightning express train at the close of the nineteenth century. Who can say what are the possibilities of electricity as a motive power!

**BLOOD**, circulates through the system in two minutes. If allowed to move in a straight line, it would move at the rate of 150 feet per minute.  
**BICYCLE**, one mile may be attained in two minutes.  
**CANNON BALL**, (24 in) at the rate of 1600 miles per hour.

**CARRIER PIGEON**, 43 miles per hour.  
**CARS**, an express train attains a speed of 60 miles per hour, 82.7 miles per hour has been attained.  
**CLOUDS**, storm clouds, apparently moving slowly, often attain a velocity of 100 miles per hour.  
**COMET (Halley's)**, in perihelion, 1,600,000 ft. per second.  
**CROW**, flies at the rate of 25 miles per hour.  
**CYCLONE**, spiral motion of winds, 180 miles per hour.  
**DUCK**, 90 miles per hour.

**EARTH**, point on equator when rotating on its axis, 1076 miles per hour. In its orbit while revolving around the sun, 68,533 miles per hour.  
**EARTHQUAKE SHOCK**, 13th Aug., 1868, 764 ft. per second; 25th July, 1895, 5,104 ft. per second.  
**EIDER DUCK**, 90 miles per hour.  
**ELECTRICITY**, submarine wire, 1,128,000 ft. per second; aerial wire, 118,152,000 ft. per second.  
**ELEVATOR**, in Western Union Telegraph Building, 15,500 ft. per minute.  
**FALCON**, 74 miles per hour.

**FALLING BODIES**, 1st second, 16 ft.; 2nd second, 64 ft.; 3rd second, 144 ft.; 4th second, 256 ft.; etc.

**GLACIERS**, for those of the first rank in the Alps, 100 yards per year; of the second rank, about 25 yards per year.

**GULF STREAM**, 4 to 5 miles per hour.

**HAWK**, 150 miles per hour.

**HORSE**, trots, 7 miles per hour; runs, 20 miles per hour. In racing the following records have at different times been made: running, 1 mile in 1 minute and 53 1/2 seconds; trotting, 1 mile in 2 minutes and 34 seconds; pacing, 1 mile in 2 minutes and 13 seconds.

**HUMMING BIRD**, at the rate of 180 miles per hour.

**HURRICANE**, 80 miles per hour.

**ICE BOAT**, is said to outrival all other modes of locomotion, it running at the rate of a mile per minute with ease.

**INSECTS**, the wings of the common housefly flap at the rate of 330 times per second; of the bumble bee, 240; of the honey bee, 180; of the wasp, 110; of the dragon fly, 28; of the gnat, 15,000.

**JUPITER**, revolves in its orbit 28,774 miles per hour.

**LIGHT**, 192,000 miles per second; passes from the sun to the earth in 8 minutes and 13 seconds from the nearest fixed star to the earth in about 34 years.

**MAN**, walks from 4 to 5 miles per hour, 1 mile has been attained by walking in 6 minutes and 23 seconds; 3 miles in 35 minutes and 10 seconds; 100 miles in 18 hours, 8 minutes and 15 seconds.

**MARS**, revolves in its orbit 53,000 miles an hour.  
**MARTIN**, 200 miles per hour.  
**MERCURY**, revolves in its orbit 105,000 miles per hour.

**METEOR**, 30 miles per second.

**MILL STONES**, 4 ft. in diameter, 120 to 140 revolutions per minute; dressing machines, 2 inches diam., 450 to 500 revolutions per minute; screen, 16 inches diam., 300 to 350 revolutions per minute.

**MOON**, in its orbit around the earth 236 miles per hour.

**MUSKET BALL**, 850 miles per hour.

**NEPTUNE**, revolves in its orbit 11,958 miles per hour.

**OCEAN WAVE**, during tempest, 50 miles per hour.

**PENDULUM**, vibrates seconds at the equator when 39.152 inches in length. Either north or south from the equator the pendulum slightly lengthens as the latitude increases.

**PIANO WIRES**, middle C, 264 times per second; one octave above, 528; one octave below, 132.

**RIFLE BALL**, 1000 miles per hour.

**RIVERS**, slow when 3 miles per hour; rapid when 7.

**ROWING**, in single scull 1 mile has been attained in 5 minutes; in double scull 1 mile in 5 minutes and 55 seconds; in four-oared shell 1 mile in 4 minutes and 51 seconds.

**RUNNING**, 1 mile has been attained in 4 minutes and 124 seconds; 5 miles in 24 minutes and 40 seconds; 100 miles in 13 hours, 26 minutes, and 30 seconds.

**SAILING VESSELS**, 10 miles per hour.

**SATURN**, in its orbit 21,221 miles per hour.

**SENSATIONS**, in human nervous, 108 ft. per second.

**SIRIUS**, 153,000 ft. per second.

**SKATING**, 1 mile in 2 minutes and 12 seconds has been attained.

**SNOW SHOES**, 1 mile in 5 minutes and 40 seconds.

**SOLAR ATMOSPHERE**, 90,000 to 180,000 ft. per second; tempest, 1,200,000 ft. per second.

**SOUND**, in dry air at 82°, 1,142 ft. per second, or about 775 miles per hour; in water, 4,900 ft. per second; in iron, 17,500 ft. in copper, 10,378; in wood, from 12,000 to 16,000 ft. per second.

**SPARROW**, 150 miles per hour.

**STEAM BOAT**, 18 miles per hour, 25 miles per hour is attainable.

**STORM**, 30 miles per hour. See Wind.

**SUN**, point on equator, 6,090 ft. per second.

**SWIFTS**, 150 miles per hour.

**SWIMMING**, 100 yds. in 1 min., 53 sec.; 300 yds. in 4 min., 8 sec.; 600 yds. in 8 min., 40 sec.; 1 mile in 26 min., 52 sec.; 20 miles in 5 hours, 51 minutes.

**TEMPEST**, 60 to 70 miles per hour. On the Sun, 240,500 miles per hour.

**TIDAL WAVE**, in open ocean, as great as 900 miles per hour.

**TRICYCLE**, 2 mile in 1 min., 15 sec.; 1 mile in 2 min., 28 sec.; 5 miles in 13 min., 50 sec.

**TROTTER**, see Horse.

**URANUS**, revolves in its orbit 14,963 miles per hour.

**VENUS**, revolves in its orbit 74,050 miles per hour.

**VULCAN**, revolves in its orbit 174,000 miles per hour.

**WALKING**, see Man.

**WAVE**, see Ocean Wave.

**WINGS**: the wing of the sparrow flaps 13 times per second; of the wild duck, 33; of the pigeon, 6; of the osprey, 6; of the humming bird, 100.

WIND,	Miles per hour.	Pressure per sq. ft. in lbs.	Characteristics.
1	.....		Not perceptible.
2	0.005		Hardly perceptible.
3	0.020		Just perceptible.
4	0.123		Gentle breeze.
5	0.492		Brisk wind.
10	1.968		Very brisk wind.
25	3.075		
35	6.027		High wind.
45	9.963		Very high wind.
50	12.300		Storm.
60	17.715		Great storm.
80	31.490		Hurricane.
100	49.200		Great hurricane.
180	.....		Cyclone.



	Date of Voyage.
Magalhaens, Portuguese, who names the Straits.	1519
Endaia, Spaniard, who names the Marquesas, or Mendana Islands.	1567
QUIROS, Spaniard.	1605
SIR FRANCIS DRAKE, first English.	1577
CAVENDISH, first voyage.	1586
LE MAIRE, Dutch.	1642
TASMAN, Dutch, who names Tasmania.	1642
DAMPIER, English.	1679
COOKE, English.	1768
ROGGEWEEN, Dutch.	1721
ANSON, British.	1740
BYRON, English.	1764
WALLIS, British.	1766
BOUGAINVILLE, French.	1766
CARTERET, English.	1766
JAMES COOK.	1768
KING, continued after Cook's death.	1779
KING AND FITZROY, British.	1826-36
BELCHER, British.	1836-42
WILKES, American.	1838-42
TRAIN, G.F., American, completed May 4, 1890, a trip around the world in 67 days, 13 hours, 3 minutes, 3 seconds, stopping over one day in New York City.	



The following is the compact as signed on board the Mayflower just before landing:  
 "In the name of God, Amen. We whose names are underwritten, the loyal subjects of our dread sovereign Lord, King James, by ye grace of God, of Great Brittain, France & Ireland king, defender of ye faith, &c., having undertaken, for ye glory of God, and advancement of ye Christian faith, and honour of our King & countries, a voyage to plant ye first colony in ye Northern parts of Virginia, do by these presents solemnly & mutually in ye presence of God, and of one another, covenant with ourselves together into a civil body politic, for no better end, to combine & preserve the same, furtherance of ye ends aforesaid; and by virtue hereof to enact, constitute, and frame such just & equal laws, ordinances, acts, constitutions & offices, from time to time, as shall be thought most meet & convenient for ye general good of ye Colony, which we promise all due submission and obedience, in witness whereof we have hereunder subscribed our names at Cape Cod the 11th November, in ye year of ye reign of our sovereign Lord, King James of England, France & Ireland, &c. of Scotland, ye fiftie fourth Anno Domini, 1620."







Price, 10 Cents.

A REFERENCE CALENDAR



COMPLIMENTS OF





San Francisco, Cal. 9/7 1893

Dear Sir: I herewith mail you a sample copy of my

J. GOODYKOOTZ, Publisher, 189

Dear Sir: Inclosed find ..... dollars

and ..... cents, for which please send me .....  
copies of your Perpetual Calendar and General Reference Tables.

# AN INSTANTANEOUS AND GENERAL PERPETUAL CALENDAR REFERENCE TABLES.

## JANUARY

January is named from the Roman *Janus*, who was the Porter of heaven, he presided over the beginning or opening of everything, hence, the first month of the year was named after him. *Januarius* was added to the list of months by Numa Pompilius, 672 B.C. Among the Romans, on the first of this month all enemies were suspended, presents were exchanged, officers were installed, etc. Thus ancient was the origin of New Year gifts.

## FEBRUARY

February is derived from *Februus*, the Roman festival of general expiation and lustration, which was celebrated during the latter part of this month. It was added to the list of months by Numa, 672 B.C. Every fourth year February has 29 days instead of 28, and such years are called "bissexile" or "leap years". In this month the *Lupercalia* were held among the Romans. It is the month of harvest in Upper Egypt.

## MARCH

March is named from *Mars*, the Roman god of war. It was the first month in the early calendar, and the legal year began with March 25th until the change from Old to New Style in the year 1752. The value of March weather is expressed in the sayings, "A peck of March dust is worth a king's ransom." "March comes in like a lion, and goes out like a lamb." Harvest month in India.

## APRIL

The derivation of April is unknown, yet there is a traditional etymology, *omnia aperit*, "it opens everything," as spring and the buds generally open in this month. All-Fools' Day (April 1) is traced through every country of Europe to the Hindus, and even farther back to the mistake of Noah in sending the dove out of the ark before the water had abated, on the Hebrew first day of the month.

## MAY

May is probably derived from *Maia*, a feminine divinity worshipped at Rome, to whom sacrifices were offered on the first day of May. The custom of observing May-day, or the first day of May, with floral and festive ceremonies, is older than the Middle Ages. The May-hike was once general in England, the young people going out before sunrise to gather flowers to adorn it.

## JUNE

June has commonly been traced to *Juno*, worshipped at Rome as the queen of heaven. The connection is found in the fact that the month of June was considered the most favorable period for marrying, and *Juno* was believed to preside over marriage. The summer solstice occurs in this month, and in the north temperate zone it is the most pleasant month of the year. Harvest month in South U.S.

## JULY

July derives its name from *Julius Caesar*, who was born on the 12th of the month. It was originally called *Quintilis*, from its having been the fifth month in the original Latin year, which began with March. This is the month of "dog days," reckoned as commencing on the 3d, and ending on the 11th of August, during which period the extreme heat of summer prevails. Harvest month in most countries in N. U.S.

## AUGUST

August owes its name to *Augustus Caesar*, who followed his illustrious predecessor by appropriating a month to himself. In the original Latin year it was called *Sextilis*, from its being the sixth month. It originally contained 30 days, but to gratify the vanity of Augustus, one day was taken from February and added to August, so as to make his month equal in extent and dignity to the month of Julius Caesar—July.

## SEPTEMBER

September is so called from the Latin *Septem*, seven, because it was the 7th month of the Roman year. This is the harvest month throughout large areas of the globe. Harvest moon is the full moon nearest the autumnal equinox (Sept. 21), so called because it enables farmers to prolong the day's work during the autumnal harvest especially favorable in the north.

## OCTOBER

October was the eighth month of the Roman calendar, which has given rise to the following: "October has its name from *octo*, eight; Though 'tis the truth, perhaps 'tis well to state, Such sixes and such sevens the months were knotted as That ten became translated into *octo*." The changing of the forests to the gorgeous and many-colored hues of autumn is characteristic of October.

## NOVEMBER

November was formerly the ninth month, now the eleventh. From *novem*, nine. This month is reckoned almost every year from its cold and blustering character, by the delightful weather known as Indian Summer, when for days or weeks the sun softens its rays mildly through a haze, rendering the air soft and genial. This month is also noted for its time-honored festival known as Thanksgiving.

## DECEMBER

December is derived from *decem*, ten, as it was formerly the tenth month. The longest nights and shortest days occur during this month, the winter solstice falling on the 21st. As the month of the Christmas holidays, which begins from Decem. 24 to Jan. 2, its cold winds and gloomy atmosphere are enlivened with the joyousness and charity of the greatest festival in the year.

## YEAR-DAY

The Year is the period of time in which the earth performs a revolution in its orbit about the sun. It consists of 365 days 5 hours 48 minutes, and 46 seconds of mean solar time. The Day is the interval of time which elapses between two consecutive returns of the same terrestrial meridian to the sun. The Week is a period of seven days, having no reference to the celestial motions—a circumstance to which it owes its unalterable uniformity.

## WEEK SEE ABOVE

PHOTO-ENGRAVED FROM NEW YORK ISSUE BY THE AUTHOR.



A CALENDAR FOR FOR ALL TIME

# GOODYKOONTZ'S PERPETUAL CALENDAR

An instantaneous reference calendar from which the complete and correct calendar for any year, either old or new style, before or after Christ, may be instantly found.

COPYRIGHT, 1892 AND 1893, BY JASPER GOODYKOONTZ.

PHOTO-ENGRAVED FROM PEN COPY MADE BY THE AUTHOR.

## YEARS OF THE CENTURIES.

	A	B	C	D	E	F	G
OS. 1400 • 5A	OS. 1600 • 3A	OS. 1800 • 1A	OS. 1900 • 7A	OS. 1700 • 2A	OS. 1500 • 4A	OS. 1300 • 6A	
N.S. 1700 • 6	N.S. 1800 • 4	N.S. 1900 • 2	N.S. 2000 • 7A				
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13
14	14	14	14	14	14	14	14
15	15	15	15	15	15	15	15
16	16	16	16	16	16	16	16
17	17	17	17	17	17	17	17
18	18	18	18	18	18	18	18
19	19	19	19	19	19	19	19
20	20	20	20	20	20	20	20
21	21	21	21	21	21	21	21
22	22	22	22	22	22	22	22
23	23	23	23	23	23	23	23
24	24	24	24	24	24	24	24
25	25	25	25	25	25	25	25
26	26	26	26	26	26	26	26
27	27	27	27	27	27	27	27
28	28	28	28	28	28	28	28
29	29	29	29	29	29	29	29
30	30	30	30	30	30	30	30
31	31	31	31	31	31	31	31
32	32	32	32	32	32	32	32
33	33	33	33	33	33	33	33
34	34	34	34	34	34	34	34
35	35	35	35	35	35	35	35
36	36	36	36	36	36	36	36
37	37	37	37	37	37	37	37
38	38	38	38	38	38	38	38
39	39	39	39	39	39	39	39
40	40	40	40	40	40	40	40
41	41	41	41	41	41	41	41
42	42	42	42	42	42	42	42
43	43	43	43	43	43	43	43
44	44	44	44	44	44	44	44
45	45	45	45	45	45	45	45
46	46	46	46	46	46	46	46
47	47	47	47	47	47	47	47
48	48	48	48	48	48	48	48
49	49	49	49	49	49	49	49
50	50	50	50	50	50	50	50

### OBSERVATIONS AND EXAMPLES.

To find the calendar for any year, look in the column of centuries at the left for the required century, at the right of which is the Century Letter for New Style (since Sept. 3, 1753), and at the left, the Century Letter for Old Style. These letters direct to corresponding letters at the tops of the double columns, in which are given the years of the centuries. At the right of each year in the double column is the Calendar Number, directing to the corresponding number of the calendars which follow. All the years of 1800 are given in the second double column under B; all the years of 1900, in the third double column, etc.

### Examples.

- 1.—Find the calendar for 1894.—Look in the column of centuries for 1800; at its right is B, directing to B at the top of the second double column; at the right of 94 in this column is 2, directing to calendar number 2, which is the correct calendar for 1894.
- 2.—On what day was Washington inaugurated President, April 30, 1789? At the right of 1700 (in century column) is A; under A in the first double column, at the right of 89 is 5; in calendar number 5 April 30th is Thursday.
- 3.—On what day did Columbus discover America, October 12, 1492?—At the left of 1400 (Old Style) is A; under A at the right of 92 is 1A; in calendar number 1A the 12th of October is Friday.

- 4.—On what day was Christ born, April 5th of the year 4 B.C.?—The years B.C. being reckoned backward, it is necessary to take the year of the century from 100, and use the century letter of the preceding century; thus, 4 (year of century) from 100 leaves 96; century letter for 100 (New Style) is C; under C in the third double column at the right of 96 is 2A; in calendar number 2A the 5th of April is Friday.
- 5.—Assuming that time has been reckoned according to the present system, On what day did Noah's deluge begin, Dec. 7, 2248 B.C.?—43 from 100 leaves 53; century letter for 2400 (preceding century) is D; calendar number for 53 under D is 2A; the 12th of December was Saturday. See at the close of calendar number 7A.



1 CALENDAR NUMBER 1																																			
JAN.	S	M	T	W	T	F	S	7	14	21	28	APRIL	S	M	T	W	T	F	S	1	8	15	22	JULY	S	M	T	W	T	F	S	1	8	15	22
FEB.	1	2	3	4	5	6	7	8	9	10	11	MAY	1	2	3	4	5	6	7	8	9	10	11	AUG.	1	2	3	4	5	6	7	8	9	10	11
MAR.	12	13	14	15	16	17	18	19	20	21	22	JUNE	12	13	14	15	16	17	18	19	20	21	22	SEPT.	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31				23	24	25	26	27	28	29	30	31			23	24	25	26	27	28	29	30	31			
2 CALENDAR NUMBER 2																																			
JAN.	S	M	T	W	T	F	S	7	14	21	28	APRIL	S	M	T	W	T	F	S	1	8	15	22	JULY	S	M	T	W	T	F	S	1	8	15	22
FEB.	1	2	3	4	5	6	7	8	9	10	11	MAY	1	2	3	4	5	6	7	8	9	10	11	AUG.	1	2	3	4	5	6	7	8	9	10	11
MAR.	12	13	14	15	16	17	18	19	20	21	22	JUNE	12	13	14	15	16	17	18	19	20	21	22	SEPT.	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31				23	24	25	26	27	28	29	30	31			23	24	25	26	27	28	29	30	31			
3 CALENDAR NUMBER 3																																			
JAN.	S	M	T	W	T	F	S	7	14	21	28	APRIL	S	M	T	W	T	F	S	1	8	15	22	JULY	S	M	T	W	T	F	S	1	8	15	22
FEB.	1	2	3	4	5	6	7	8	9	10	11	MAY	1	2	3	4	5	6	7	8	9	10	11	AUG.	1	2	3	4	5	6	7	8	9	10	11
MAR.	12	13	14	15	16	17	18	19	20	21	22	JUNE	12	13	14	15	16	17	18	19	20	21	22	SEPT.	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31				23	24	25	26	27	28	29	30	31			23	24	25	26	27	28	29	30	31			
4 CALENDAR NUMBER 4																																			
JAN.	S	M	T	W	T	F	S	7	14	21	28	APRIL	S	M	T	W	T	F	S	1	8	15	22	JULY	S	M	T	W	T	F	S	1	8	15	22
FEB.	1	2	3	4	5	6	7	8	9	10	11	MAY	1	2	3	4	5	6	7	8	9	10	11	AUG.	1	2	3	4	5	6	7	8	9	10	11
MAR.	12	13	14	15	16	17	18	19	20	21	22	JUNE	12	13	14	15	16	17	18	19	20	21	22	SEPT.	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31				23	24	25	26	27	28	29	30	31			23	24	25	26	27	28	29	30	31			
5 CALENDAR NUMBER 5																																			
JAN.	S	M	T	W	T	F	S	7	14	21	28	APRIL	S	M	T	W	T	F	S	1	8	15	22	JULY	S	M	T	W	T	F	S	1	8	15	22
FEB.	1	2	3	4	5	6	7	8	9	10	11	MAY	1	2	3	4	5	6	7	8	9	10	11	AUG.	1	2	3	4	5	6	7	8	9	10	11
MARCH	12	13	14	15	16	17	18	19	20	21	22	JUNE	12	13	14	15	16	17	18	19	20	21	22	SEPT.	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31				23	24	25	26	27	28	29	30	31			23	24	25	26	27	28	29	30	31			



## 6 CALENDAR NUMBER 6

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
1	10	11	12	13	14	15	16	1	1	2	3	4	5	6	7	1	1	2	3	4	5	6	7	1	1	2	3	4	5	6	
2	20	21	22	23	24	25	26	2	8	9	10	11	12	13	14	2	8	9	10	11	12	13	14	2	8	9	10	11	12	13	
3	30	31						3	15	16	17	18	19	20	21	3	15	16	17	18	19	20	21	3	15	16	17	18	19	20	
4	40	41	42	43	44	45	46	4	22	23	24	25	26	27	28	4	22	23	24	25	26	27	28	4	22	23	24	25	26	27	
5	50	51	52	53	54	55	56	5	29	30	31					5	29	30	31					5	29	30	31				
6	60	61	62	63	64	65	66	6	36	37	38	39	40	41	42	6	36	37	38	39	40	41	42	6	36	37	38	39	40	41	
7	70	71	72	73	74	75	76	7	43	44	45	46	47	48	49	7	43	44	45	46	47	48	49	7	43	44	45	46	47	48	
8	80	81	82	83	84	85	86	8	50	51	52	53	54	55	56	8	50	51	52	53	54	55	56	8	50	51	52	53	54	55	
9	90	91	92	93	94	95	96	9	57	58	59	60	61	62	63	9	57	58	59	60	61	62	63	9	57	58	59	60	61	62	
10	100	101	102	103	104	105	106	10	64	65	66	67	68	69	70	10	64	65	66	67	68	69	70	10	64	65	66	67	68	69	
11	110	111	112	113	114	115	116	11	71	72	73	74	75	76	77	11	71	72	73	74	75	76	77	11	71	72	73	74	75	76	
12	120	121	122	123	124	125	126	12	78	79	80	81	82	83	84	12	78	79	80	81	82	83	84	12	78	79	80	81	82	83	
13	130	131	132	133	134	135	136	13	85	86	87	88	89	90	91	13	85	86	87	88	89	90	91	13	85	86	87	88	89	90	
14	140	141	142	143	144	145	146	14	92	93	94	95	96	97	98	14	92	93	94	95	96	97	98	14	92	93	94	95	96	97	
15	150	151	152	153	154	155	156	15	99	100	101	102	103	104	105	15	99	100	101	102	103	104	105	15	99	100	101	102	103	104	
16	160	161	162	163	164	165	166	16	106	107	108	109	110	111	112	16	106	107	108	109	110	111	112	16	106	107	108	109	110	111	
17	170	171	172	173	174	175	176	17	113	114	115	116	117	118	119	17	113	114	115	116	117	118	119	17	113	114	115	116	117	118	
18	180	181	182	183	184	185	186	18	120	121	122	123	124	125	126	18	120	121	122	123	124	125	126	18	120	121	122	123	124	125	

## 7 CALENDAR NUMBER 7

JAN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FEB.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
MAR.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JULY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
AUG.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
SEPT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
OCT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
NOV.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
DEC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

## IA CALENDAR NUMBER IA

[illegible]

## 2A CALENDAR NUMBER 2A

JAN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FEB.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
MAR.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JULY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
AUG.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
SEPT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
OCT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
NOV.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
DEC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

## 3A CALENDAR NUMBER 3A

[illegible]

# 4A CALENDAR NUMBER 4A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31	

# 5A CALENDAR NUMBER 5A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31	

# 6A CALENDAR NUMBER 6A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31	

# 7A CALENDAR NUMBER 7A

JAN.	S	M	T	W	T	F	S	APRIL	S	M	T	W	T	F	S	JULY	S	M	T	W	T	F	S	OCT.	S	M	T	W	T	F	S
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31		25	26	27	28	29	30	31	

## NOTES ON THE CALENDAR.

The century letters, at the right of the column of centuries, are given both A.D. and B.C. in New Style in order to represent regular succession of time from the advent of man on the earth, 4-004 B.C., until the present, and all future time.

To find the century letter for any century beyond those given in the column of centuries, it is only necessary to remember that every centesimal leap-year (every centesimal year divisible by 4-00) has D for its century letter; then the next century, A; then B and

C, and so on forever; thus, 8-400 has D; 8500, A; 8600, B; 8700, C; 8800, D; etc.

If it be desirable to use the Old Style century letters beyond those given at the left of the column of centuries, repeat them in the same order as given. There are two methods of reckoning the years B.C. known as the "Astronomers' Method," and the "Chronologers' Method." The former method is used in this Calendar, as it represents regular succession of years from B.C. to A.D., while the latter does not. The difference between the two methods may be seen from the following illustrations:

4342 1012345 = Astronomers' Method.  
4342 112345 = Chronologers' Method.

The years B.C. and A.D. are reckoned from the point 0(0-year) the same as the degrees on the scale of a thermometer are reckoned above and below 0(0-degree).

There have been two defects in Perpetual Calendars that have heretofore rendered them impracticable for general use; viz., The liability to find the incorrect date, and the time required to point out any given date.

Should any one feel disposed to discredit the accuracy of this calendar, if he will furnish proof of such, he will be amply rewarded for his trouble.

The calendar for any year may be found with in the limit of six seconds.



# ERAS COMPARED.

CENTURIES OF DECLARATION OF INDEPENDENCE OF U.S.A.	CENTURIES OF THE JEWISH ERA.	CENTURIES OF THE MUNDANE ERAUSHER.	CENTURIES OF THE JULIAN PERIOD.	CENTURIES OF THE CHRISTIAN PERIOD.	CENTURIES OF THE CHRISTIAN PERIOD.	CENTURIES OF THE CHRISTIAN PERIOD.
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9
10	10	10	10	10	10	10
11	11	11	11	11	11	11
12	12	12	12	12	12	12
13	13	13	13	13	13	13
14	14	14	14	14	14	14
15	15	15	15	15	15	15
16	16	16	16	16	16	16
17	17	17	17	17	17	17
18	18	18	18	18	18	18
19	19	19	19	19	19	19
20	20	20	20	20	20	20
21	21	21	21	21	21	21
22	22	22	22	22	22	22
23	23	23	23	23	23	23
24	24	24	24	24	24	24
25	25	25	25	25	25	25
26	26	26	26	26	26	26
27	27	27	27	27	27	27
28	28	28	28	28	28	28
29	29	29	29	29	29	29
30	30	30	30	30	30	30
31	31	31	31	31	31	31
32	32	32	32	32	32	32
33	33	33	33	33	33	33
34	34	34	34	34	34	34
35	35	35	35	35	35	35
36	36	36	36	36	36	36
37	37	37	37	37	37	37
38	38	38	38	38	38	38
39	39	39	39	39	39	39
40	40	40	40	40	40	40
41	41	41	41	41	41	41
42	42	42	42	42	42	42
43	43	43	43	43	43	43
44	44	44	44	44	44	44
45	45	45	45	45	45	45
46	46	46	46	46	46	46
47	47	47	47	47	47	47
48	48	48	48	48	48	48
49	49	49	49	49	49	49
50	50	50	50	50	50	50

# NOTES ON THE ERAS.

The Christian Era commenced on Saturday (Old Style), January 1 of the year 1 A.D. The first Julian Period commenced January 1, 4713 B.C., and ends January 1, 3268 A.D. The Mundane Era commenced with October 4004 B.C. The Jewish Era commenced with October 3761 B.C. The Era of the Declaration of Independence commenced July 4, 1776 A.D.

The Christian Era is used by the nations of the civilized world and the centuries of the other eras are made to correspond with it.

To find the year of the century of any of the other eras corresponding to any given year of the Christian era, add the year of the century to the number found on the same parallel—thus, to find the year of the Declaration of Independence corresponding to 1892, add 92 to 24; for the Jewish era, add 3761 to 1892, add 92 to 24; for the Julian Period, add 4713 to 1892.

The years and centuries of the Christian era are reckoned both forward and backward from its beginning A.D.

# MOVABLE FESTIVALS.

To find the day of the month upon which the following festivals occur for any year, use the Easter Sunday Table below, and the Perpetual Calendar.

Septuagesima 9th Sunday before Easter.  
 Sexagesima 8th " " " "  
 Quinquagesima 7th " " " "  
 Shrove Tuesday 7th Tuesday " "  
 Ash Wednesday 7th Wednesday " "  
 First Sunday in Lent 6th Sunday " "  
 Second " 5th " " " "  
 Third " 4th " " " "  
 Fourth " 3rd " " " "  
 Fifth " 2nd " " " "  
 Palm Sunday 1st Sunday " "  
 Good Friday 1st Friday " "  
 Maundy Thursday 1st Thursday " "  
 EASTER, see table below.  
 Low Sunday 1st Sunday after Easter.  
 Ascension 6th Thursday " "  
 Whit Sunday or Pentecost 7th Sunday " "  
 Trinity Sunday 8th " " " "  
 Corpus Christi 9th Thursday " "  
 First Sunday in Advent 4th Sunday before Christmas.  
 Second " 3rd " " " "  
 Third " 2nd " " " "  
 Fourth " 1st " " " "  
 CHRISTMAS, December 25. (Not movable.)

# FIXED FESTIVALS AND HOLIDAYS.

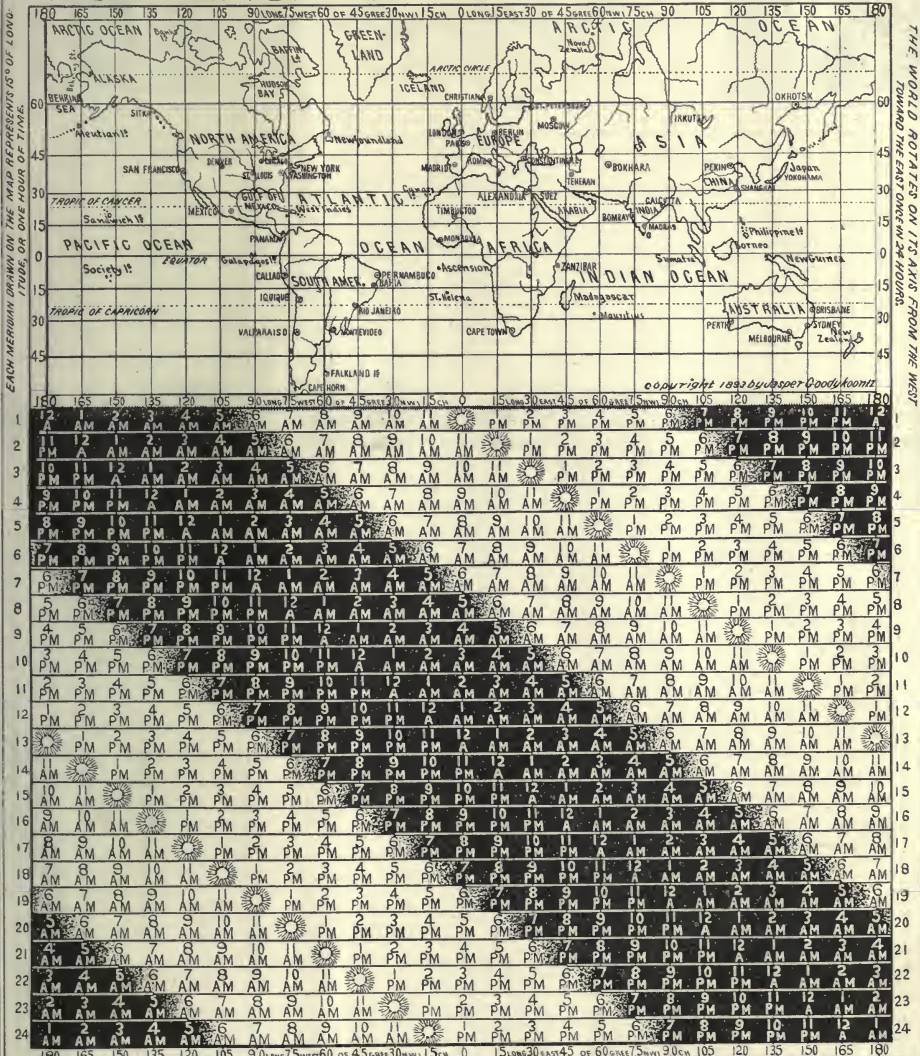
JANUARY 1, New Year's Day and Circumcision of Epiphany.  
 FEBRUARY 2, Purification of Mary; St. Valentine's Day; 22, Washington's Birthdays; 24, St. Matthias' Day.  
 MARCH 1, St. Patrick's Day; 25, Annunciation or Lady Day.  
 APRIL 23, St. George's Day; 25, St. Mark's Day.  
 MAY 1, St. Joseph's and St. James' 30, Memorial Day.  
 JUNE 11, St. Barnabas' Day; 24, St. John Baptist's Day; 29, St. Peter's Day.  
 JULY 4, Independence Day; 25, St. James' Day.  
 AUGUST 24, St. Bartholomew's Day.  
 SEPTEMBER, first Monday, Labor Day; 21, St. Matthew's Day; 29, St. Michael's Day; 18, St. Luke's Day; 28, St. Simon and St. Jude's 31, Halloween.  
 NOVEMBER, all Saints' Day; first Tuesday after first Monday, General Election Day; last Thursday, Thanksgiving; 30, St. Andrew's Day.  
 DECEMBER 6, St. Nicholas' Day; 21, St. Thomas' Day; 25, Christmas; 26, St. Stephen's Day; 29, St. John Evangelist's Day; 29, Innocent's Day.

# EASTER SUNDAY TABLE FOR 600 YEARS.

PREVIOUS TO 1752 THE DATES ARE COMPUTED FROM THE OLD STYLE. IN THE TABLE A EQUALS APRIL AND M EQUALS MARCH.

1500	A 29	1600	M 23	1700	M 31	1800	A 13	1900	A 25	2000	A 23
1	11	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13	13	13	13	13
14	14	14	14	14	14	14	14	14	14	14	14
15	15	15	15	15	15	15	15	15	15	15	15
16	16	16	16	16	16	16	16	16	16	16	16
17	17	17	17	17	17	17	17	17	17	17	17
18	18	18	18	18	18	18	18	18	18	18	18
19	19	19	19	19	19	19	19	19	19	19	19
20	20	20	20	20	20	20	20	20	20	20	20
21	21	21	21	21	21	21	21	21	21	21	21
22	22	22	22	22	22	22	22	22	22	22	22
23	23	23	23	23	23	23	23	23	23	23	23
24	24	24	24	24	24	24	24	24	24	24	24
25	25	25	25	25	25	25	25	25	25	25	25
26	26	26	26	26	26	26	26	26	26	26	26
27	27	27	27	27	27	27	27	27	27	27	27
28	28	28	28	28	28	28	28	28	28	28	28
29	29	29	29	29	29	29	29	29	29	29	29
30	30	30	30	30	30	30	30	30	30	30	30
31	31	31	31	31	31	31	31	31	31	31	31
32	32	32	32	32	32	32	32	32	32	32	32
33	33	33	33	33	33	33	33	33	33	33	33
34	34	34	34	34	34	34	34	34	34	34	34
35	35	35	35	35	35	35	35	35	35	35	35
36	36	36	36	36	36	36	36	36	36	36	36
37	37	37	37	37	37	37	37	37	37	37	37
38	38	38	38	38	38	38	38	38	38	38	38
39	39	39	39	39	39	39	39	39	39	39	39
40	40	40	40	40	40	40	40	40	40	40	40
41	41	41	41	41	41	41	41	41	41	41	41
42	42	42	42	42	42	42	42	42	42	42	42
43	43	43	43	43	43	43	43	43	43	43	43
44	44	44	44	44	44	44	44	44	44	44	44
45	45	45	45	45	45	45	45	45	45	45	45
46	46	46	46	46	46	46	46	46	46	46	46
47	47	47	47	47	47	47	47	47	47	47	47
48	48	48	48	48	48	48	48	48	48	48	48
49	49	49	49	49	49	49	49	49	49	49	49
50	50	50	50	50	50	50	50	50	50	50	50

# CHART SHOWING LOCAL TIME FOR EACH OF THE 24 HOURS.

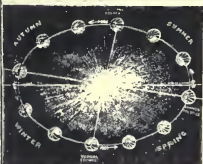


TO USE THE CHART, DESCEND ON YOUR LOCAL MERIDIAN TO THE REQUIRED HOUR OF THE DAY. ON THE RIGHT, IF YOU PASS TO THE RIGHT OR LEFT; THUS, WHEN IT IS 9 A.M. AT NEW YORK IT IS 10 A.M. IN THE WESTERN PART OF AUSTRALIA.

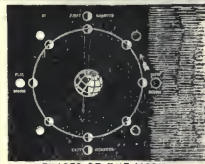


# Perpetual Sunset and Sunrise Table.

To find the time of sunset or sunrise for any day in any year, find the day of the month (or its nearest approximate) as given under the column of months at the right and left; then pass inward to the column headed by your latitude (or its nearest approximate) where will be found the time of sunset and sunrise. By approximation the exact time may be found. To find the length of the day, double the time of sunset; thus, May 20, in latitude 37°, is 14 hours 16 minutes long. To find the length of the night, double the time of sunrise; thus, on the above date, the night is 9 hours 44 minutes long. On the same day, as shown by the column "Sun down or fast," the sun is 4 minutes faster than mean time. After finding your latitude, draw a red line on each side of the column from top to bottom, so as to catch the eye at a glance.



POSITION OF EARTH AT DIFFERENT SEASONS.



PHASES OF THE MOON.



## L A T I T U D E

COPYRIGHT, 1892, BY JASPER GODDYKONTZ.



POSITION OF EARTH AT DIFFERENT SEASONS.		PHASES OF THE MOON.		L A T I T U D E		PHASES OF THE MOON.		POSITION OF EARTH AT DIFFERENT SEASONS.	
MONTHS.		MONTHS.		L A T I T U D E		MONTHS.		MONTHS.	
SUN DOWN OR FAST.		SUN DOWN OR FAST.		SUN DOWN OR FAST.		SUN DOWN OR FAST.		SUN DOWN OR FAST.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.		SUN RISES.	
SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.		SUN SETS.	
SUN RISES.		SUN RISES.		SUN RISES					

AS SEEN FROM MERCURY

VENUS

EARTH

MARS

VESTA

JUNO

CERES

PALLAS

JUPITER

SATURN

NEPTUNE

URANUS

NEPTUNE

JUPITER

SATURN

NEPTUNE

JUPITER

SATURN

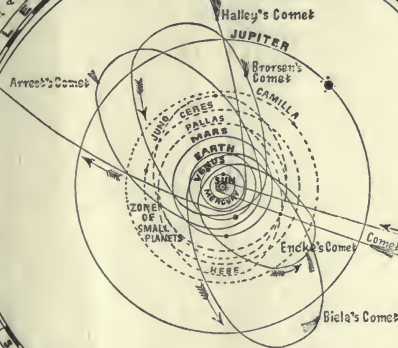
## THE SOLAR SYSTEM.

The Solar System consists of the Sun, the eight large planets, the names of which are given at the left, one hundred and forty small planets, a vast number of meteoric bodies, an unknown number of comets, and a ring of nebulous matter known as the Zodiacal Light.

### PLANETS.

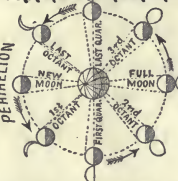
The planets which move directly around the Sun are called primary planets; those which move around their primaries are called secondary planets, also called moons or satellites. The Earth has 1 satellite; Jupiter, 4; Saturn, 3; Uranus, 2; Neptune, 1. Saturn is also surrounded by a circular belt. The planets move round the Sun from west to east. Their orbits are elliptical, so that they are nearer the Sun at certain times than at others. When nearest the Sun they are in perihelion; when farthest, in aphelion.

## THE SOLAR SYSTEM.

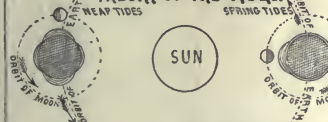


Owing to their great distance the orbits of Uranus and Neptune cannot be shown on this diagram.

### PHASES OF THE MOON.



### THEORY OF THE TIDES.



### THE SUN.

The mean distance of the Sun from the Earth is 91,000,000 miles. Its diameter is 852,584 miles. Its volume is 1,200,000 times greater than that of the Earth. It revolves on its axis once in about 25 days. On the Sun's disc are seen various cavities called sun-spots.

### METEORS.

Meteors are also called shooting stars. The number that traverse the atmosphere daily is upward of the number, 400,000,000. The Zodiacal Light is a lenticular-shaped bluish of light visible after sunset in early spring, and before sunrise in early autumn. It is supposed to be due to a ring of meteorites revolving around the Sun.

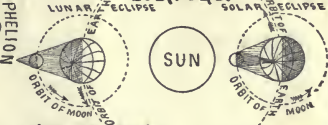
### THE ASTEROIDS.

Of the Asteroids or small planets, there are about 140. In dimensions, they are a great deal smaller than the others, the largest not being 230 miles in diameter, while many are less than 50 miles. Their orbits are more elliptical than those of the large planets, and at many places cross each other. They occupy a belt more than 200,000,000 miles in width, between the orbits of Jupiter and Mars, their distance from the Sun ranging from 200,000,000 to 300,000,000 of miles.

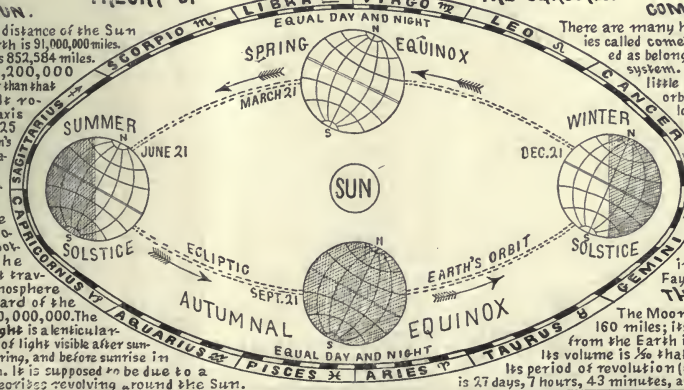
### THE PLANETS.

PLANET	DIAMETER IN MILES	LENGTH OF DAY IN HOURS	LENGTH OF YEAR IN DAYS	MOON'S PERIOD IN DAYS	HOURLY MOTION IN MILES
MERCURY	2,967	88.24	88	88	105,000
VENUS	7,510	223.25	225	225	77,050
EARTH	7,926	365.24	365	29.5	65,533
MARS	4,220	687.24	687	687	32,000
JUPITER	87,770	4,333.3	4,333	10.9	28,744
SATURN	72,800	10,759.1	10,759	29.5	21,221
URANUS	32,024	10,667.9	10,668	360	11,958
NEPTUNE	36,620	60,121.7	60,122	360	11,958

### ECLIPSES.



### THE SEASONS.



### COMETS.

There are many hundreds of bodies called comets, and recognized as belonging to the solar system. They consist of a little matter, and their orbits are greatly elongated. Only a part of the comets have tails, and these are often 150,000,000 miles in length. Halley's comet revolves in 76 years; Biela's in 6 years, 9 months; Encke's in 3 1/2 years; and Faye's in 7 1/2 years.

### THE MOON.

The Moon's diameter is 2,160 miles; its mean distance from the Earth is 237,519 miles. Its volume is 1/50 that of the Earth. Its period of revolution (also of rotation) is 27 days, 7 hours, 43 minutes, and 5 seconds.

FROM THE GLOBE OF THE WORLD.

COMET OF 1892, BY JACOB GOODRICH.



# BUSINESS TIME TABLES.

## I—TIME TABLE NUMBER—I.

Showing the Number of Days from the Beginning and to the End of the Year.

JAN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	APR.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	JUN.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	JULY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	AUG.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SEPT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	OCT.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	NOV.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	DEC.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																																																																																																																																																																																																																																																																																																																														
364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000

### OBSERVATIONS AND EXAMPLES.

#### TIME TABLE NUMBER I.

The table applies to common years only. For leap years, one day must be added after passing February 28. The bold-faced type represent the days of the month, and the small type above and below the bold-faced type represent the days from the beginning and to the end of the year, as shown by the direction of the arrows.

**Example 1.**—To find the difference between two dates within the year, take the difference between the days from the beginning and the days to the end of the year: thus, from March 5 to Oct. 27 is (300—64) 236 days.

**Example 2.**—If one date fall within the year following the current year, add the number of days to the end of the year to the number from the beginning: thus, from June 3rd to February 16 in the following year is (211+47) 258 days.

**Example 3.**—If one date fall within the year preceding the current year, add the number of days from the beginning of the year to the number to the end of the year: thus, from May 4 to Sept. 18, of the preceding year (reckoning backward) is (124+104) 228 days.

#### TIME TABLE NUMBER 2.

There being a table for each the common and the leap years, select the table to suit the year. Select the month from which the date is reckoned, at the top of the table, then descend the column to the month to which the date is reckoned, where will be found the exact number of days. The small figures, from 1 to 12, show the number of months.

**Example 1.**—What is the number of days from July 4 to March 4 (common year)?—From July at the top of the table, descend the column to March, where is found 243, the exact number of days.

**Example 2.**—Find the number of days from Feb. 14 to Sept. 21 (Leap year).—From

Feb. at the top descend to Sept., where is found 213, which is the number of days to the 14th of Sept.; then to the 21st is 7 days more, making 220 days.

**Example 3.**—Required, the number of days from June 1 to Oct. 1 of the following year. From June at the top descend to June, where is found 365; thence descend to Oct., where is found 124, which added to 365, equals 487.

**Example 4.**—A note maturing Sept. 13, is discounted June 24 previous; what is the time to run?—From June 24 to Sept. 24, by the table, is 92 days; the 13th being 11 days before, gives (92—11) 81 days.

#### TIME TABLE NUMBER 3.

The table applies to common years only. For leap years, add one day after passing Feb. 28.

**Example.** Find the number of days between March 17 and Feb. 4 in the following year.—The figures opposite the 17th day in the first March column are 76; opposite the 4th day of second Feb. col. are 400; diff. = 324.

## 2-TIME TABLE NUMBER-2.

Showing the Number of Days from any one Month to the same Day of any other Month.

FROM	FOR COMMON YEARS.												TO
	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	JULY.	AUG.	SEP.	OCT.	NOV.	DEC.	
JAN.	365	334	308	275	245	214	184	153	122	92	61	31	JAN.
FEB.	12	11	10	9	8	7	6	5	4	3	2	1	FEB.
MAR.	59	28	365	334	304	273	243	212	181	151	120	90	MAR.
APR.	90	59	31	365	335	304	274	243	212	182	151	121	APR.
MAY	120	89	61	30	365	334	304	273	242	212	181	151	MAY
JUNE	151	120	92	61	31	365	335	304	273	243	212	182	JUNE
JULY	181	150	122	91	61	30	365	334	303	273	242	212	JULY
AUG.	212	181	153	122	92	61	31	365	334	304	273	243	AUG.
SEP.	243	212	184	153	123	92	62	31	365	335	304	274	SEP.
OCT.	273	243	214	183	153	123	92	61	30	365	334	304	OCT.
NOV.	304	273	245	214	184	153	123	92	61	31	365	335	NOV.
DEC.	334	303	275	244	214	183	153	122	91	61	30	365	DEC.
FROM													
FROM	FOR LEAP YEARS.												TO
	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	JULY.	AUG.	SEP.	OCT.	NOV.	DEC.	
JAN.	366	335	308	275	245	214	184	153	122	92	61	31	JAN.
FEB.	12	11	10	9	8	7	6	5	4	3	2	1	FEB.
MAR.	60	29	366	335	305	274	244	213	182	151	120	90	MAR.
APR.	91	60	31	366	338	305	275	244	213	183	152	122	APR.
MAY	121	90	61	30	366	335	305	274	243	213	182	152	MAY
JUNE	152	121	92	61	31	366	336	305	274	244	213	183	JUNE
JULY	182	151	122	91	61	30	366	335	304	274	243	213	JULY
AUG.	213	182	153	122	92	61	31	366	335	305	274	244	AUG.
SEP.	244	213	184	153	123	92	62	31	366	336	305	275	SEP.
OCT.	274	243	214	183	153	123	92	61	30	366	335	305	OCT.
NOV.	305	274	245	214	184	153	123	92	61	31	366	336	NOV.
DEC.	335	304	275	244	214	183	153	122	91	61	30	366	DEC.

## 3-TIME TABLE NUMBER-3.

Showing the Number of Days between any two Days within three Years.

DA.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	DA.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	1	31	60	91	121	152	182	213	244	274	305	335	1	1	31	60	91	121	152	182	213	244	274	305	335
2	366	335	308	275	245	214	184	153	122	92	61	31	2	366	335	308	275	245	214	184	153	122	92	61	31
3	12	11	10	9	8	7	6	5	4	3	2	1	3	12	11	10	9	8	7	6	5	4	3	2	1
4	59	28	365	334	304	273	243	212	181	151	120	90	4	59	28	365	334	304	273	243	212	181	151	120	90
5	90	59	31	365	335	304	274	243	212	182	151	121	5	90	59	31	365	335	304	274	243	212	182	151	121
6	120	89	61	30	365	334	304	273	242	212	181	151	6	120	89	61	30	365	334	304	273	242	212	181	151
7	151	120	92	61	31	365	335	304	273	243	212	182	7	151	120	92	61	31	365	335	304	273	243	212	182
8	181	150	122	91	61	30	365	334	303	273	242	212	8	181	150	122	91	61	30	365	334	303	273	242	212
9	212	181	153	122	92	61	31	365	334	304	273	243	9	212	181	153	122	92	61	31	365	334	304	273	243
10	243	212	184	153	123	92	62	31	365	335	304	274	10	243	212	184	153	123	92	62	31	365	335	304	274
11	273	243	214	183	153	123	92	61	30	365	334	304	11	273	243	214	183	153	123	92	61	30	365	334	304
12	304	273	245	214	184	153	123	92	61	31	365	335	12	304	273	245	214	184	153	123	92	61	31	365	335
13	334	303	275	244	214	183	153	122	91	61	30	365	13	334	303	275	244	214	183	153	122	91	61	30	365
14	1	31	60	91	121	152	182	213	244	274	305	335	14	1	31	60	91	121	152	182	213	244	274	305	335
15	366	335	308	275	245	214	184	153	122	92	61	31	15	366	335	308	275	245	214	184	153	122	92	61	31
16	12	11	10	9	8	7	6	5	4	3	2	1	16	12	11	10	9	8	7	6	5	4	3	2	1
17	59	28	365	334	304	273	243	212	181	151	120	90	17	59	28	365	334	304	273	243	212	181	151	120	90
18	90	59	31	365	335	304	274	243	212	182	151	121	18	90	59	31	365	335	304	274	243	212	182	151	121
19	120	89	61	30	365	334	304	273	242	212	181	151	19	120	89	61	30	365	334	304	273	242	212	181	151
20	151	120	92	61	31	365	335	304	273	243	212	182	20	151	120	92	61	31	365	335	304	273	243	212	182
21	181	150	122	91	61	30	365	334	303	273	242	212	21	181	150	122	91	61	30	365	334	303	273	242	212
22	212	181	153	122	92	61	31	365	334	304	273	243	22	212	181	153	122	92	61	31	365	334	304	273	243
23	243	212	184	153	123	92	62	31	365	335	304	274	23	243	212	184	153	123	92	62	31	365	335	304	274
24	273	243	214	183	153	123	92	61	30	365	334	304	24	273	243	214	183	153	123	92	61	30	365	334	304
25	304	273	245	214	184	153	123	92	61	31	365	335	25	304	273	245	214	184	153	123	92	61	31	365	335
26	334	303	275	244	214	183	153	122	91	61	30	365	26	334	303	275	244	214	183	153	122	91	61	30	365
27	1	31	60	91	121	152	182	213	244	274	305	335	27	1	31	60	91	121	152	182	213	244	274	305	335
28	366	335	308	275	245	214	184	153	122	92	61	31	28	366	335	308	275	245	214	184	153	122	92	61	31
29	12	11	10	9	8	7	6	5	4	3	2	1	29	12	11	10	9	8	7	6	5	4	3	2	1
30	59	28	365	334	304	273	243	212	181	151	120	90	30	59	28	365	334	304	273	243	212	181	151	120	90
31	90	59	31	365	335	304	274	243	212	182	151	121	31	90	59	31	365	335	304	274	243	212	182	151	121
32	120	89	61	30	365	334	304	273	242	212	181	151	32	120	89	61	30	365	334	304	273	242	212	181	151
33	151	120	92	61	31	365	335	304	273	243	212	182	33	151	120	92	61	31	365	335	304	273	243	212	182
34	181	150	122	91	61	30	365	334	303	273	242	212	34	181	150	122	91	61	30	365	334	303	273	242	212
35	212	181	153	122	92	61	31	365	334	304	273	243	35	212	181	153	122	92	61	31	365	334	304	273	243
36	243	212	184	153	123	92	62	31	365	335	304	274	36	243	212	184	153	123	92	62	31	365	335	304	274
37	273	243	214	183	153	123	92	61	30	365	334	304	37	273	243	214	183	153	123	92	61	30	365	334	304
38	304	273	245	214	184	153	123	92	61	31	365	335	38	304	273	245	214	184	153	123	92	61	31	365	335
39	334	303	275	244	214	183	153	122	91	61	30	365	39	334	303	275	244	214	183	153	122	91	61	30	365
40	1	31	60	91	121	152	182	213	244	274	305	335	40	1	31	60	91	121	152	182	213	244	274	305	335
41	366	335	308	275	245	214	184	153	122	92	61	31	41	366	335	308	275	245	214	184	153	122	92	61	31
42	12	11	10	9	8	7	6	5	4	3	2	1	42	12	11	10	9	8	7	6	5	4	3	2	1
43	59	28	365	334	304	273	243	212	181	151	120	90	43	59	28	365	334	304	273	243	212	181	151	120	90
44	90	59	31	365	335	304	274	243	212	182	151	121	44	90	59	31	365	335	304	274	243	212	182	151	121
45	120	89	61	30	365	334	304	273	242	212	181	151	45	120	89	61	30	365	334	304	273	242	212	181	151
46	151	120	92	61	31	365	335	304	273	243	212	182	46	151	120	92	61	31	365	335	304	273	243	212	182
47	181	150	122	91	61	30	365	334	303	273	242	212	47	181	150	122	91	61	30	365	334	303	273	242	212
48	212	181	153	122	92	61	31	365	334	304	273	243	48	212	181	153	122	92	61	31	365	334	304	273	243
49	243	212	184	153	123	92	62	31	365	335	304	274	49	243	212	184	153	123	92	62	31	365	335	304	274
50	273	243	214	183	153	123	92	61	30	365	334	304	50	273	243	214	183	153	123	92	61	30	365	334	304
51	304	273	245	214	184	153	123	92	61	31	365	335	51	304	273	245	214	184	153	123	92	61	31	365	335
52	334	303	275	244	214	183	153	122	91	61	30	365	52	334	303	275	244	214	183	153	122	91	61	30	365
53	1	31	60	91	121	152	182	213	244	274	305	335	53	1	31	60	91	121	152	182	213	244	274	305	335
54	366	335	308	275	245	214	184	153	122	92	61	31	54	366	335	308	275	245	214	184	153	122	92	61	31
55	12	11	10	9	8	7	6	5	4	3	2	1	55	12	11	10	9	8	7	6	5	4	3	2	1
56	59	28	365	334	304	273	243	212	181	151	120	90	56	59	28	365	334	304	273	243	212	181	151	120	90
57	90	59	31	365	335	304	274	243	212	182	151	121	57	90	59	31	365	335	304	274	243	212	182	151	121
58	120	89	61	30	365	334	304	273	242	212	181	151	58	120	89	61	30	365	334	304	273	242	212	181	151
59	151	120	92	61	31	365	335	304	273	243	212	182	59	151	120	92	61	31	365	335	304	273	243	212	182
60	181	150	122	91	61	30	365	334	303	273	242	212	60	181	150	122	91	61	30	365	334	303	273	242	212
61	212	181	153	122	92	61	31	365	334	304	273	243	61	212	181	153	122	92	61	31	365	334	304	273	



# INSTANTANEOUS METHOD OF COMPUTING INTEREST

To find the interest on any sum for any time, at any rate per cent. given in the table, find the interest (1) on the sum for the years; (2) for the months; (3) for the days, and then add the several results together.

**AT FOUR PER CENT**

**DAYS**

[illegible]

## MONT

	1	2	3	4	5	6	7	8	9	10	11
INTEREST	1	0	0	1	1	1	2	3	3	3	3
INTEREST	2	0	0	0	0	0	2	2	3	3	1
INTEREST	3	0	0	0	0	0	2	2	3	3	1
INTEREST	4	0	0	0	0	0	2	2	3	3	1
INTEREST	5	0	0	0	0	0	2	2	3	3	1
INTEREST	6	0	0	0	0	0	2	2	3	3	1
INTEREST	7	0	0	0	0	0	2	2	3	3	1
INTEREST	8	0	0	0	0	0	2	2	3	3	1
INTEREST	9	0	0	0	0	0	2	2	3	3	1
INTEREST	10	0	0	0	0	0	2	2	3	3	1
INTEREST	11	0	0	0	0	0	2	2	3	3	1
INTEREST	12	0	0	0	0	0	2	2	3	3	1
INTEREST	13	0	0	0	0	0	2	2	3	3	1
INTEREST	14	0	0	0	0	0	2	2	3	3	1
INTEREST	15	0	0	0	0	0	2	2	3	3	1
INTEREST	16	0	0	0	0	0	2	2	3	3	1
INTEREST	17	0	0	0	0	0	2	2	3	3	1
INTEREST	18	0	0	0	0	0	2	2	3	3	1
INTEREST	19	0	0	0	0	0	2	2	3	3	1
INTEREST	20	0	0	0	0	0	2	2	3	3	1
INTEREST	21	0	0	0	0	0	2	2	3	3	1
INTEREST	22	0	0	0	0	0	2	2	3	3	1
INTEREST	23	0	0	0	0	0	2	2	3	3	1
INTEREST	24	0	0	0	0	0	2	2	3	3	1
INTEREST	25	0	0	0	0	0	2	2	3	3	1
INTEREST	26	0	0	0	0	0	2	2	3	3	1
INTEREST	27	0	0	0	0	0	2	2	3	3	1
INTEREST	28	0	0	0	0	0	2	2	3	3	1
INTEREST	29	0	0	0	0	0	2	2	3	3	1
INTEREST	30	0	0	0	0	0	2	2	3	3	1
INTEREST	31	0	0	0	0	0	2	2	3	3	1
INTEREST	32	0	0	0	0	0	2	2	3	3	1
INTEREST	33	0	0	0	0	0	2	2	3	3	1
INTEREST	34	0	0	0	0	0	2	2	3	3	1
INTEREST	35	0	0	0	0	0	2	2	3	3	1
INTEREST	36	0	0	0	0	0	2	2	3	3	1
INTEREST	37	0	0	0	0	0	2	2	3	3	1
INTEREST	38	0	0	0	0	0	2	2	3	3	1
INTEREST	39	0	0	0	0	0	2	2	3	3	1
INTEREST	40	0	0	0	0	0	2	2	3	3	1
INTEREST	41	0	0	0	0	0	2	2	3	3	1
INTEREST	42	0	0	0	0	0	2	2	3	3	1
INTEREST	43	0	0	0	0	0	2	2	3	3	1
INTEREST	44	0	0	0	0	0	2	2	3	3	1
INTEREST	45	0	0	0	0	0	2	2	3	3	1
INTEREST	46	0	0	0	0	0	2	2	3	3	1
INTEREST	47	0	0	0	0	0	2	2	3	3	1
INTEREST	48	0	0	0	0	0	2	2	3	3	1
INTEREST	49	0	0	0	0	0	2	2	3	3	1
INTEREST	50	0	0	0	0	0	2	2	3	3	1
INTEREST											

## YEARS

1	2	3	4	5	6	7	8
2	8	12	16	20	24	28	32
5	10	22	32	40	48	56	64
12	24	36	48	60	72	84	96
16	32	48	64	80	96	112	128
20	40	60	80	100	120	140	160
24	48	72	96	120	144	168	192
28	56	84	112	140	168	196	224
32	64	96	128	160	192	224	256
36	72	108	144	180	216	252	288
40	80	120	160	200	240	280	320
48	96	144	192	240	288	336	384
56	112	168	224	280	336	392	448
64	128	192	256	320	384	448	512
72	144	216	288	360	432	504	576
80	160	240	320	400	480	560	640
88	176	264	352	440	528	616	704
96	192	288	384	480	576	672	768
104	208	312	416	520	624	728	832
112	224	336	448	560	672	784	896
120	240	360	480	600	720	840	960
128	256	384	512	640	768	896	1024
136	272	408	544	680	816	960	1088
144	288	432	576	720	864	1024	1152
152	304	456	608	760	912	1088	1216
160	320	480	640	800	960	1152	1280
168	336	504	672	840	1008	1216	1344
176	352	528	704	880	1056	1280	1408
184	368	552	736	920	1104	1344	1472
192	384	576	768	960	1152	1408	1536
200	400	600	800	1000	1200	1472	1600
208	416	624	832	1040	1248	1536	1664
216	432	648	864	1080	1296	1600	1728
224	448	672	896	1120	1344	1664	1792
232	464	696	928	1160	1392	1728	1856
240	480	720	960	1200	1440	1792	1920
248	496	744	992	1240	1488	1856	1984
256	512	768	1024	1280	1536	1920	2048
264	528	792	1056	1320	1584	1984	2112
272	544	816	1088	1360	1632	2048	2176
280	560	840	1120	1400	1680	2112	2240
288	576	864	1152	1440	1728	2176	2304
296	592	888	1184	1480	1776	2240	2368
304	608	912	1216	1520	1824	2304	2432
312	624	936	1248	1560	1872	2368	2496
320	640	960	1280	1600	1920	2432	2560
328	656	984	1312	1640	1968	2496	2624
336	672	1008	1344	1680	2016	2560	2688
344	688	1032	1376	1720	2064	2624	2752
352	704	1056	1408	1760	2112	2688	2816
360	720	1080	1440	1800	2160	2752	2880
368	736	1104	1472	1840	2208	2816	2944
376	752	1128	1504	1880	2256	2880	3008
384	768	1152	1536	1920	2304	2944	3072
392	784	1176	1568	1960	2352	3008	3136
400	800	1200	1600	2000	2400	3072	3200
408	816	1224	1632	2040	2448	3136	3264
41							

AT FIVE PER CENT

## PLAYS

[illegible]

# MONT

[illegible]

## Y E A R S

1	2	3	4	5	6	7	8
5	10	15	20	25	30	35	40
10	20	30	40	50	60	70	80
15	30	45	60	75	90	105	120
20	40	60	80	100	120	140	160
25	50	75	100	125	150	175	200
30	60	90	120	150	180	210	240
35	70	105	140	175	210	245	280
40	80	120	160	200	240	280	320
45	90	135	180	225	270	315	360
50	100	150	200	250	300	350	400
55	110	165	220	275	330	385	440
60	120	180	240	300	360	420	480
65	130	195	260	325	390	455	520
70	140	210	280	350	420	490	560
75	150	225	300	375	450	525	600
80	160	240	320	400	480	560	640
85	170	255	340	425	510	595	680
90	180	270	360	450	540	630	720
95	190	285	380	475	570	665	760
100	200	300	400	500	600	700	800





# GEOGRAPHY OF THE HEAVENS

## DESCRIPTION OF THE MAPS.

THE MAP OF THE NORTHERN HEMISPHERE REPRESENTS THE CONCAVE SURFACE OF THE NORTHERN HALF OF THE HEAVENS, AND THE SOUTHERN HEMISPHERE THAT OF THE SOUTHERN. THE CELESTIAL EQUATOR OR EQUINOCTIAL IS REPRESENTED ON THE MAP BY THE LARGE CIRCLE AROUND THE MARGIN, IT IS TO THE VIEW-ERS RIGHT. THE EARTH'S EQUATOR IS TO THE SOUTH. THE LINES RUNNING PARALLEL TO IT AND ENCIRCLING THE POLES ARE CALLED MERIDIANS, OR MERIDIAN LINES. THEY CORRESPOND TO THE PARALLELS OF LATITUDE ON THE EARTH. THE LINES DRAWN FROM THE EQUINOCTIAL TO THE POLES AT INTERVALS OF 15° ARE CALLED HOURS, OR HOURS OF RIGHT ASCENSION. OR HOUR CIRCLES. THEY CORRESPOND TO THE HOURS OF LONGITUDE ON THE EARTH. THE LINES DRAWN FROM THE EQUINOCTIAL TO THE POLES AT INTERVALS OF 15° ARE CALLED HOURS, OR HOURS OF RIGHT ASCENSION. OR HOUR CIRCLES. THEY CORRESPOND TO THE HOURS OF LONGITUDE ON THE EARTH. THE LINES DRAWN FROM THE EQUINOCTIAL TO THE POLES AT INTERVALS OF 15° ARE CALLED HOURS, OR HOURS OF RIGHT ASCENSION. OR HOUR CIRCLES. THEY CORRESPOND TO THE HOURS OF LONGITUDE ON THE EARTH.

## THE GREEK ALPHABET USED IN NAMING THE STARS.

Α ΑΛΦΑ Β ΒΕΤΑ Γ ΓΑΜΜΑ Δ ΔΕΛΤΑ Ε ΕΠΣΙΛΟΝ ΣΤ ΣΤΕΤΑ Ζ ΖΗΤΑΣ Η ΗΕΤΑΣ Θ ΘΕΤΑΣ Ι ΙΟΤΑΣ Κ ΚΑΡΔΑ Λ ΛΑΜΒΔΑ Μ ΜΥΚΟΣ Ν ΝΕΜΟΣ Ξ ΞΙΝΟΣ Ο ΟΜΕΓΑ Π ΠΕΡΣΙΟΝ Ρ ΡΗΤΑ Σ ΣΙΓΜΑ Τ ΤΑΥ ΤΥΡΩΝΟΝ Υ ΥΠΕΡΒΟΛΟΝ Φ ΦΙ Χ ΧΙΣ Ψ ΨΙ ΔΩ ΔΩΜΕΓΑ

## THE CONSTELLATIONS.

TO FIND ANY CONSTELLATION ON THE MAPS, LOOK IN THE LIST BELOW FOR THE DECLINATION AND RIGHT ASCENSION. IF THE DECLINATION BE NORTH, LOOK IN THE NORTHERN HEMISPHERE; IF SOUTH, LOOK IN THE SOUTHERN. IF THE RIGHT ASCENSION BE NORTH, LOOK IN THE NORTH; IF SOUTH, LOOK IN THE SOUTH. IF THE DECLINATION BE NORTH, LOOK IN THE NORTHERN HEMISPHERE; IF SOUTH, LOOK IN THE SOUTHERN. IF THE RIGHT ASCENSION BE NORTH, LOOK IN THE NORTH; IF SOUTH, LOOK IN THE SOUTH.

## THE DIPPER.

TO FIND THE DIPPER, LOOK IN THE LIST BELOW FOR THE DECLINATION AND RIGHT ASCENSION. IF THE DECLINATION BE NORTH, LOOK IN THE NORTHERN HEMISPHERE; IF SOUTH, LOOK IN THE SOUTHERN. IF THE RIGHT ASCENSION BE NORTH, LOOK IN THE NORTH; IF SOUTH, LOOK IN THE SOUTH.

COPYRIGHT 1893, BY JASPER GOODYKOONZ.

## NAMES OF THE CONSTELLATIONS WITH THEIR LOCATION ON THE CELESTIAL CHART SHOWN.

NAMES OF CONSTELLATIONS.	DECLINATION NORTH	DECLINATION SOUTH	NAMES OF CONSTELLATIONS.	DECLINATION NORTH	DECLINATION SOUTH	NAMES OF CONSTELLATIONS.	DECLINATION NORTH	DECLINATION SOUTH	NAMES OF CONSTELLATIONS.	DECLINATION NORTH	DECLINATION SOUTH
ANDROMEDA.	30N	1	CHAMELEON.	75S	10	HERCULES.	30N	17	NAVIS ARGO.	15S	9
ANTARES.	2N	20	COELA SCALPTORIS.	35S	5	MOROLOGION.	48S	3	NORMA.	45S	16
ANTILIA TYPOGRAPHIA.	15S	8	COLUMBA.	35S	6	MYDRA.	4N	9	NUBECULA MAJOR.	70S	5
APPARATUS SCULPTORIS.	74S	0	COMA BERENICES.	22N	13	MYRUS.	75S	3	NUBECULA MINOR.	75S	2
AQUARIUS.	21N	21	CORONA AUSTRALIS.	40S	19	INDUS.	40S	61	OCTANS.	85S	17
AQUILA.	15N	19	CORONA BOREALIS.	30N	16	LYCERTA.	45N	22	OPHIUCHUS.	15N	17
ARAB.	50S	17	CRABUS.	15S	12	LEPUS.	24S	6	ORION.	70S	1
ARIES.	25N	3	CRATER.	15S	11	LEO.	15N	11	PAVO.	80N	19
AURIGA.	38N	6	CRUX.	60S	12	LEO MINOR.	30N	10	PEGASUS.	30N	22
AVIS PARADISI.	75S	16	CUSTOS MESSIUM.	70N	2	LIBRA.	21N	15	PERSEUS.	45N	3
BOIES.	10N	14	CYGNUS.	45N	20	LINEA NAUTICA.	30S	9	PHENIX.	45S	1
CAMELOPARDUS.	15N	8	DELPHINUS.	15N	21	LUPUS.	35S	13	PISCES.	15N	1
CAMELOPARDUS.	75N	6	DORADO.	60S	15	LYNX.	45N	8	PISCIS AUSTRALIS.	30S	22
CANNES VENATICI.	45N	13	DRACO.	60N	17	LYRA.	40N	19	PISCIS VOLANS.	70S	8
CANIS MAJOR.	20S	7	EQUEUS PICTORIS.	50S	6	MACHINA ELECTRICA.	30S	2	SALICRUS.	2N	4
CANIS MINOR.	30N	8	ENDROMEDUS.	30N	4	MACHINA PNEUMATICA.	15S	10	SALUTARIUM GEORGIUM.	15S	3
CAPRICORNUS.	15S	21	FELIS.	15S	10	MICROSCOPUM.	40S	21	SCYTHIA.	25S	9
CAPUT MEDUSAE.	35N	3	FORNAX CHIMICA.	30S	3	MONOCEROS.	4N	7	UROS AUSTRALIS.	15S	15
CASSIOPEIA.	60N	1	GEMINI.	15N	7	MONS MENSAE.	10N	14	URSA MINOR.	60S	4
CENTAURUS.	45S	13	GLORIA AEROSTATICUS.	30S	21	MONS MENSAE.	75S	4	URSA MAJOR.	45S	11
CERES.	60N	22	GLORIA FREDERICI.	45N	23	MUSCA AUSTRALIS.	70S	17	VIRGO.	20N	10
CETUS.	8N	3	GRUS.	45S	22	MUSCA BOREALIS.	30N	3	VULPECULA ET ANSER.	25N	20









# TWILIGHT TABLE.



Showing the beginning and end of twilight for the first, eleventh, and twenty-first days of every month, as seen on the parallels of 27°, 30°, 33°, 36°, 39°, 42°, 45°, and 48° north latitude, and by estimation, will serve equally well for adjacent points.

Months.	LATITUDE.																							
	27°		30°		33°		36°		39°		42°		45°		48°									
	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.	Begins.	Ends.
JAN.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	5 28	6 45	5 33	6 47	5 38	6 50	5 40	6 28	5 43	6 24	5 45	6 21	5 48	6 20	5 53	6 18	5 58	6 15	5 58	6 12	5 58	6 12	5 58	6 12
" 11	5 27	6 50	5 30	6 51	5 36	6 43	5 39	6 34	5 42	6 32	5 46	6 19	5 49	6 17	5 50	6 16	5 52	6 14	5 54	6 13	5 54	6 13	5 54	6 13
" 21	5 26	6 54	5 29	6 55	5 33	6 47	5 37	6 31	5 40	6 29	5 44	6 18	5 47	6 16	5 50	6 14	5 53	6 12	5 56	6 11	5 56	6 11	5 56	6 11
FEB.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	5 22	7 8	5 26	6 59	5 30	6 57	5 32	6 54	5 35	6 52	5 37	6 50	5 39	6 49	5 42	6 48	5 44	6 46	5 46	6 44	5 48	6 42	5 50	6 40
" 11	5 20	7 8	5 22	7 8	5 24	7 7	5 25	7 4	5 26	7 2	5 27	7 0	5 28	6 59	5 30	6 58	5 32	6 56	5 34	6 54	5 36	6 52	5 38	6 50
" 21	5 16	7 14	5 16	7 13	5 15	7 13	5 15	7 12	5 15	7 11	5 17	7 9	5 17	7 7	5 18	7 6	5 19	7 5	5 20	7 4	5 21	7 3	5 22	7 2
MAR.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	5 8	7 18	5 7	7 18	5 6	7 19	5 5	7 20	5 4	7 21	5 3	7 23	4 58	7 25	4 58	7 27	4 58	7 29	4 58	7 31	4 58	7 33	4 58	7 35
" 11	5 0	7 22	4 57	7 24	4 53	7 27	4 51	7 29	4 49	7 31	4 46	7 35	4 43	7 37	4 42	7 39	4 42	7 41	4 42	7 43	4 42	7 45	4 42	7 47
" 21	4 50	7 27	4 46	7 31	4 41	7 35	4 38	7 38	4 36	7 42	4 27	7 47	4 21	7 50	4 15	7 54	4 15	7 56	4 15	7 58	4 15	7 60	4 15	7 62
APR.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	4 37	7 32	4 29	7 37	4 24	7 42	4 19	7 48	4 16	7 54	4 6	8 2	3 52	8 8	3 45	8 15	3 45	8 22	3 45	8 29	3 45	8 36	3 45	8 43
" 11	4 25	7 40	4 18	7 46	4 10	7 53	4 3	7 59	3 56	8 7	3 46	8 16	3 31	8 29	3 18	8 42	3 18	8 49	3 18	8 56	3 18	9 03	3 18	9 10
" 21	4 15	7 48	4 5	7 57	3 55	8 2	3 47	8 12	3 37	8 20	3 25	8 32	3 13	8 47	3 56	9 3	3 56	9 10	3 56	9 17	3 56	9 24	3 56	9 31
MAY.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	4 0	8 0	3 51	8 17	3 42	8 12	3 31	8 22	3 21	8 33	3 6	8 48	2 53	9 7	2 35	9 27	2 35	9 34	2 35	9 41	2 35	9 48	2 35	9 55
" 11	3 45	8 11	3 37	8 18	3 30	8 25	3 17	8 33	3 5	8 45	2 47	9 6	2 29	9 31	2 6	9 54	2 6	9 54	2 6	9 54	2 6	9 54	2 6	9 54
" 21	3 30	8 21	3 26	8 27	3 21	8 32	3 7	8 44	2 52	8 57	2 31	9 23	2 8	9 52	1 34	10 26	1 34	10 26	1 34	10 26	1 34	10 26	1 34	10 26
JUNE.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	3 17	8 32	3 17	8 37	3 13	8 43	2 57	9 0	2 41	9 14	2 17	9 38	1 49	10 18	1 9	10 51	1 9	10 51	1 9	10 51	1 9	10 51	1 9	10 51
" 11	3 21	8 41	3 13	8 45	3 10	8 51	2 50	9 11	2 36	9 28	2 13	9 51	1 39	10 30	1 24	11 36	1 24	11 36	1 24	11 36	1 24	11 36	1 24	11 36
" 21	3 15	8 44	3 11	8 49	3 8	8 54	2 45	9 22	2 30	9 25	2 8	9 50	1 34	10 37	1 18	11 50	1 18	11 50	1 18	11 50	1 18	11 50	1 18	11 50
JULY.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	3 30	8 37	3 19	8 44	3 20	8 48	3 15	8 52	3 0	9 9	2 39	9 29	2 2	9 58	1 25	10 21	1 25	10 21	1 25	10 21	1 25	10 21	1 25	10 21
" 11	3 42	8 27	3 33	8 38	3 29	8 40	3 27	8 43	3 15	8 57	2 57	9 16	2 18	9 52	1 50	10 9	1 50	10 9	1 50	10 9	1 50	10 9	1 50	10 9
" 21	3 55	8 14	3 47	8 10	3 50	8 19	3 40	8 29	3 29	8 41	3 13	8 57	2 36	9 22	2 12	9 49	2 12	9 49	2 12	9 49	2 12	9 49	2 12	9 49
AUG.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	4 16	7 45	4 6	7 57	3 59	8 7	3 51	8 15	3 41	8 22	3 28	8 35	2 59	9 0	2 34	9 20	2 34	9 20	2 34	9 20	2 34	9 20	2 34	9 20
" 11	4 20	7 41	4 14	7 41	4 7	7 36	4 2	7 58	3 55	8 4	3 45	8 14	3 24	8 35	3 5	8 51	3 5	8 51	3 5	8 51	3 5	8 51	3 5	8 51
" 21	4 25	7 22	4 20	7 30	4 15	7 31	4 11	7 40	4 7	7 46	3 59	7 54	3 50	8 30	3 32	8 25	3 32	8 25	3 32	8 25	3 32	8 25	3 32	8 25
SEP.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	4 25	7 15	4 26	7 17	4 23	7 10	4 20	7 25	4 17	7 28	4 12	7 37	4 5	7 48	3 50	8 7	3 50	8 7	3 50	8 7	3 50	8 7	3 50	8 7
" 11	4 36	7 8	4 33	7 9	4 31	7 10	4 29	7 11	4 27	7 12	4 24	7 15	4 20	7 13	4 26	7 4	4 26	7 4	4 26	7 4	4 26	7 4	4 26	7 4
" 21	4 40	7 0	4 39	6 57	4 39	6 54	4 38	6 55	4 37	6 56	4 35	6 58	4 30	7 19	4 26	7 34	4 26	7 34	4 26	7 34	4 26	7 34	4 26	7 34
OCT.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	4 47	6 46	4 46	6 45	4 46	6 43	4 45	6 47	4 45	6 50	4 44	6 52	4 41	7 3	4 38	7 22	4 38	7 22	4 38	7 22	4 38	7 22	4 38	7 22
" 11	4 52	6 37	4 53	6 35	4 54	6 33	4 55	6 31	4 57	6 35	4 58	6 29	5 0	6 49	5 2	7 11	5 2	7 11	5 2	7 11	5 2	7 11	5 2	7 11
" 21	5 0	6 30	5 6	6 28	5 2	6 26	5 3	6 23	5 19	6 25	5 9	6 18	5 13	6 30	5 16	7 0	5 16	7 0	5 16	7 0	5 16	7 0	5 16	7 0
NOV.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
" 1	5 10	6 28	5 13	6 25	5 10	6 22	5 9	6 21	5 15	6 18	5 11	6 14	5 8	6 30	5 32	6 48	5 32	6 48	5 32	6 48	5 32	6 48	5 32	6 48
" 11	5 15	6 24	5 20	6 22	5 25	6 19	5 29	6 15	5 33	6 12	5 39	6 10	5 44	6 9	5 53	6 24	5 53	6 24	5 53	6 24	5 53	6 24	5 53	6 24
" 21	5 20	6 23	5 26	6 20	5 31	6 19	5 36	6 13	5 40	6 10	5 44	6 9	5 48	6 15	5 53	6 12	5 53	6 12	5 53	6 12	5 53	6 12	5 53	6 12



# WEATHER WISDOM.



**Weather** is the condition of the atmosphere at any time and place with respect chiefly to its temperature, humidity, clearness or cloudiness, rain, fog, or snow, and wind.

**Barometer.**—In prognosticating the weather by the barometer, notice whether it be greatly above or below the mean height, and the rapidity of its rise or fall. Higher and steady, foretells continued fair weather. Lower and falling, rain, or damp cloudy weather. Rapid rise or fall, continued unsettled weather and much wind.

**Clouds.**—Clouds are distinguished by their textures, motions, and outlines. The **cirrus**, or "mare's tails," appear at a greater elevation than other forms, and are marked by their light texture, fibrous and sundered, or interlacing as in the far-spreading white cloud which produces the halo. **Small**, regularly

formed groups of these clouds are frequently seen in fair and settled weather. The **cirri** are also the clouds on the fore-part of the storm, where they are usually more abundant, very ragged, and generally blend into a white, far-reaching cloud-bank. The **cumulus**, "thunder-heads," or "cotton bales," are of a hemispherical form, with horizontal base. When they appear in the heat of the day and pass away in the evening, they foretell continued fair weather. If they increase rapidly, sink into the lower atmosphere, and remain as evening approaches, rain is at hand. Loose patches on their surfaces predict showers. The **stratus** appear as a continuous layer of widely extended sheet of cloud, at a lower level than the cumulus, and often touching the earth.

**Corona.**—Circles around the moon or sun. Growing smaller they indicate rain; growing larger, fair weather.

**Fogs.**—Fogs indicate settled weather. Morning fogs seldom last till noon.

**Frost.**—First and last frosts are usually preceded by a temperature much above mean.

**Halo** (sun-dogs).—Large circles, or parts of circles, about the sun or moon. A halo after fine weather indicates a storm.

**Rainbows.**—A morning rainbow indicates rain; an evening one, fair weather.

**Sky Color.**—A deep blue sky, even if seen through clouds, indicates fair weather; a growing whiteness, a storm.

**Sunset Colors.**—A gray, lowering sunset, or one where the sky is green or yellowish green, indicates rain. A red sunset foretells fine weather.

**Sunrise Colors.**—A red sunrise, with lowering clouds later in the morning, indicate rain; a gray sunrise, dry weather.

**Visibility.**—Unusual clearness of the atmosphere, unusual brightness or twinkling of the stars, indicate rain.



# PERPETUAL MOONLIGHT CHART.

**To Find the Phase of the Moon for Any Day in Any Year.**—Add the number of the month to the epoch of the required year, and the sum will be the number of the shaded space showing the amount of light and darkness for that month; thus, for July, 1892, 1 (epoch for 1892) added to 7 (number of July) equals 8; in space 8, on the First Quarter, as shown by the diagram. Thus, is on the 16th; New Moon on the 24th, and First Quarter

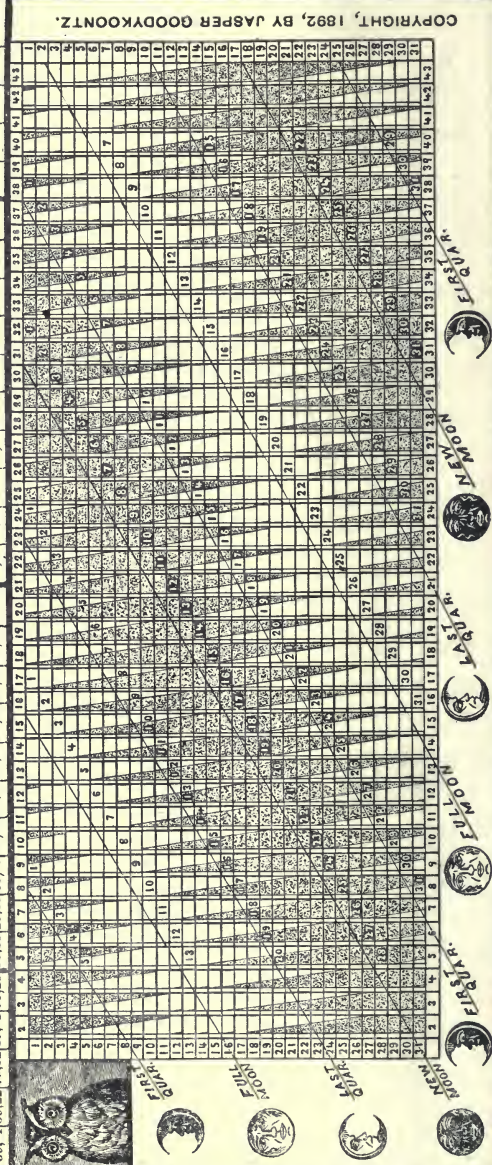


again on the 31st.  
The numbers at the right and left margins, also those running diagonally across the chart, are the days of the month; those at the top and bottom margins are the numbers of the spaces showing the amount of light and darkness for each month.  
Observe the solar and lunar inequalities and the inequalities in the length of the months, the astronomical New Moon may occur one or two days before or after the *metra* time as shown by the chart.

1-JAN. 2-FEB. 3-MAR. 4-APRIL. 5-MAY. 6-JUNE. 7-JULY. 8-AUG. 9-SEPT. 10-OCT. 11-NOV. 12-DEC.

## TABLE OF EPACTS FROM THE YEAR 1750 TO THE YEAR 2050.

1700	1800-4	1900-20	2000-24
50, 22, 60, 17, 50, 34, 23, 90, 14, 1, 51, 11, 6, 21, 29, 31, 17, 41, 7, 51, 28, 61, 18, 71, 9, 51, 30, 30, 91, 20, 52, 61, 21, 71, 81, 4, 1, 91, 25, 2, 26, 12, 17, 22, 7, 32, 25, 42, 15, 52, 9, 62, 25, 2, 46, 12, 6, 22, 27, 32, 17, 42, 8	1, 15, 11, 6, 21, 29, 31, 17, 41, 7, 51, 28, 61, 18, 71, 9, 51, 30, 30, 91, 20, 52, 61, 21, 71, 81, 4, 1, 91, 25, 2, 26, 12, 17, 22, 7, 32, 25, 42, 15, 52, 9, 62, 25, 2, 46, 12, 6, 22, 27, 32, 17, 42, 8	1, 10, 11, 30, 21, 21, 31, 11, 41, 2, 51, 22, 61, 13, 71, 3, 61, 24, 91, 14, 2, 21, 12, 11, 22, 2, 32, 22, 42, 13, 52, 3, 62, 24, 72, 14, 82, 5, 62, 25, 2, 46, 12, 6, 22, 27, 32, 17, 42, 8	1, 5, 11, 25, 21, 16, 31, 6, 41, 27, 2, 46, 12, 6, 22, 27, 32, 17, 42, 8



COPYRIGHT, 1892, BY JASPER GOODYKOONTZ.









# JEWISH CALENDAR

The Jewish year is luni-solar, and is ordinarily or embolismic, consisting of twelve or thirteen lunar months, each of which has 29 or 30 days. The length of the ordinary year is 354 days, and of the embolismic, 384 days; in either case, it is sometimes made a day more or a day less, in order that certain festivals may fall on proper days of the week.

The distribution of the embolismic years in each cycle of 19 years, is determined according to the following rule: The number of a Jewish year having its commencement in a Gregorian year is obtained by adding 3761; divide the Jewish year by 19; then the quotient is the number of the completed cycle, and the remainder is the year of the current cycle; if the remainder be 3, 6, 8, 11, 14, 17, or 19, 0, the year is embolismic; if any other, the year is ordinary.

The calendar is constructed on the assumption that the mean lunation is 29 days 12 hours

4 minutes 29 seconds, and that the year commences, on, or immediately after, the new moon following the autumnal equinox. The mean solar year is also assumed to be 365 days 5 hours 55 minutes 25 2/3 seconds, so that a cycle of nineteen sun months, is the exact measure of 235 of the assumed lunations.

After the dates of the commencement of the successive years are adjusted, an estimate of the consecutive intervals, by taking the difference, will show the duration and character of the years that respectively intervene. According to the number of days thus found to be contained in the different years, the days of the several months are distributed as in the table of months. The signs + and - are respectively annexed to Hesevan and Kislew to indicate that the former of these months may sometimes require to have one day more, and the latter, one day less, than the number of days shown in the table, - the result, in every

case, being at once determined by the total number of days that the year may happen to contain.

JEWISH MONTHS.			PRINCIPAL DAYS OF THE HEBREW CALENDAR.	
HEBREW MONTHS.	ORDINARY YEAR.	EMBOLISMIC YEAR.	TISRI	1, New Year, Feast of Trumpets
TISRI	30	30	1	2, Fast of Gedaliah.
HESVAN	29+	29+	2	3, Fast of Exaltion.
KISLEV	30-	30-	3	4, 15, Feast of Tabernacles.
TEBET	29	29	4	21, Last Day of the Festival.
SEBAST	30	30	5	22, Feast of the 8th Day.
ADAR	30	30	6	23, Rejoicing of the Law.
(VEADAR)	(+)	(29)	7	24, Dedication of Temples.
NISAN	30	30	8	25, Fast of Esther.
YIAR	29	29	9	14, Purim.
SIVAN	30	30	10	15, Pasover.
TAMUZ	29	29	11	16, Pentecost.
AB	30	30	12	17, 18, Fast of 7th and 8th Days.
ELUL	30	30	13	19, Destruction of Temple.

TABLE OF HEBREW YEARS, (FROM WOOLHOUSE'S WEIGHTS, MEASURES, ETC.)

JEWISH YEAR.	NUMBER OF DAYS.	COMMENCEMENT (IST OF TISRI).	JEWISH YEAR.	NUMBER OF DAYS.	COMMENCEMENT (IST OF TISRI).	JEWISH YEAR.	NUMBER OF DAYS.	COMMENCEMENT (IST OF TISRI).	JEWISH YEAR.	NUMBER OF DAYS.	COMMENCEMENT (IST OF TISRI).
5006	354	THUR. 2 OCT. 1845	5663	355	THUR. 2 OCT. 1904	5720	355	SAT. 3 OCT. 1959	5777	353	MON. 3 OCT. 2016
7	355	MON. 21 SEPT. 1846	64	354	TUE. 22 SEPT. 1903	21	354	THUR. 22 SEPT. 1960	78	354	MON. 21 SEPT. 2017
8	353	SAT. 11 SEPT. 1847	65	355	SAT. 10 SEPT. 1904	22	353	MON. 11 SEPT. 1961	79	353	MON. 10 SEPT. 2018
9	354	THUR. 26 SEPT. 1848	66	353	SAT. 12 SEPT. 1905	23	354	THUR. 23 SEPT. 1962	80	354	MON. 30 SEPT. 2019
10	355	MON. 7 SEPT. 1849	67	354	THUR. 20 SEPT. 1906	24	355	THUR. 1 SEPT. 1963	81	355	SAT. 19 SEPT. 2020
11	355	SAT. 7 SEPT. 1850	68	353	MON. 9 SEPT. 1907	25	355	MON. 7 SEPT. 1964	82	354	TUES. 7 SEPT. 2021
12	353	SAT. 27 SEPT. 1851	69	355	SAT. 26 SEPT. 1908	26	353	MON. 27 SEPT. 1965	83	355	MON. 26 SEPT. 2022
13	354	TUES. 14 SEPT. 1852	70	353	THUR. 16 SEPT. 1909	27	355	THUR. 15 SEPT. 1966	84	353	SAT. 16 SEPT. 2023
14	355	MON. 3 OCT. 1853	71	354	TUES. 4 OCT. 1910	28	354	THUR. 5 OCT. 1967	85	355	THUR. 3 OCT. 2024
15	353	SAT. 23 SEPT. 1854	72	355	SAT. 23 SEPT. 1911	29	353	MON. 23 SEPT. 1968	86	354	TUES. 23 SEPT. 2025
16	354	THUR. 30 SEPT. 1855	73	354	TUE. 12 SEPT. 1912	30	354	THUR. 30 SEPT. 1969	87	355	SAT. 24 SEPT. 2026
17	355	TUES. 30 SEPT. 1856	74	353	SAT. 2 OCT. 1913	31	354	THUR. 1 OCT. 1970	88	355	SAT. 2 OCT. 2027
18	355	SAT. 19 SEPT. 1857	75	355	MON. 21 SEPT. 1914	32	355	MON. 20 SEPT. 1971	89	354	THUR. 21 SEPT. 2028
19	353	THUR. 9 SEPT. 1858	76	353	THUR. 9 SEPT. 1915	33	353	SAT. 9 SEPT. 1972	90	353	MON. 10 SEPT. 2029
20	354	THUR. 23 SEPT. 1859	77	354	THUR. 28 SEPT. 1916	34	355	THUR. 27 SEPT. 1973	91	355	SAT. 28 SEPT. 2030
21	353	THUR. 17 SEPT. 1860	78	355	THUR. 17 SEPT. 1917	35	354	TUES. 17 SEPT. 1974	92	354	THUR. 18 SEPT. 2031
22	355	THUR. 5 SEPT. 1861	79	353	SAT. 5 SEPT. 1918	36	355	SAT. 16 SEPT. 1975	93	353	MON. 6 SEPT. 2032
23	354	THUR. 26 SEPT. 1862	80	354	THUR. 12 SEPT. 1919	37	354	SAT. 13 SEPT. 1976	94	355	SAT. 24 SEPT. 2033
24	353	MON. 14 SEPT. 1863	81	355	MON. 13 SEPT. 1920	38	354	TUES. 13 SEPT. 1977	95	355	THUR. 14 SEPT. 2034
25	355	SAT. 1 OCT. 1864	82	353	MON. 3 OCT. 1921	39	355	MON. 22 OCT. 1978	96	354	THUR. 4 OCT. 2035
26	354	THUR. 21 SEPT. 1865	83	354	SAT. 23 SEPT. 1922	40	355	SAT. 22 SEPT. 1979	97	353	MON. 22 SEPT. 2036
27	355	MON. 10 SEPT. 1866	84	354	TUES. 11 SEPT. 1923	41	353	THUR. 11 SEPT. 1980	98	355	THUR. 10 SEPT. 2037
28	353	MON. 30 SEPT. 1867	85	355	MON. 29 SEPT. 1924	42	354	TUES. 29 SEPT. 1981	99	354	THUR. 30 SEPT. 2038
29	354	THUR. 17 SEPT. 1868	86	353	SAT. 19 SEPT. 1925	43	355	SAT. 18 SEPT. 1982	100	355	THUR. 19 SEPT. 2039
30	355	MON. 6 SEPT. 1869	87	354	THUR. 9 SEPT. 1926	44	353	THUR. 16 SEPT. 1983	101	354	SAT. 6 SEPT. 2040
31	353	SAT. 26 SEPT. 1870	88	354	TUES. 27 SEPT. 1927	45	354	THUR. 27 SEPT. 1984	102	355	THUR. 26 SEPT. 2041
32	354	SAT. 16 SEPT. 1871	89	355	SAT. 15 SEPT. 1928	46	353	MON. 16 SEPT. 1985	103	355	MON. 15 SEPT. 2042
33	355	THUR. 3 OCT. 1872	90	353	SAT. 5 OCT. 1929	47	355	SAT. 4 OCT. 1986	104	353	MON. 5 OCT. 2043
34	353	THUR. 22 SEPT. 1873	91	354	TUES. 23 SEPT. 1930	48	354	THUR. 24 SEPT. 1987	105	355	TUES. 22 SEPT. 2044
35	354	SAT. 12 SEPT. 1874	92	355	SAT. 12 SEPT. 1931	49	353	MON. 12 SEPT. 1988	106	354	TUES. 12 SEPT. 2045
36	355	THUR. 30 SEPT. 1875	93	353	SAT. 1 OCT. 1932	50	355	SAT. 30 SEPT. 1989	107	355	MON. 1 OCT. 2046
37	354	TUES. 19 SEPT. 1876	94	354	THUR. 21 SEPT. 1933	51	354	THUR. 20 SEPT. 1990	108	353	SAT. 24 SEPT. 2047
38	355	SAT. 8 SEPT. 1877	95	355	MON. 10 SEPT. 1934	52	353	THUR. 8 SEPT. 1991	109	354	TUES. 8 SEPT. 2048
39	353	SAT. 28 SEPT. 1878	96	354	SAT. 28 SEPT. 1935	53	355	MON. 28 SEPT. 1992	110	355	THUR. 27 SEPT. 2049
40	354	THUR. 18 SEPT. 1879	97	353	THUR. 17 SEPT. 1936	54	355	THUR. 16 SEPT. 1993	111	355	SAT. 17 SEPT. 2050
41	355	MON. 6 SEPT. 1880	98	354	MON. 6 SEPT. 1937	55	354	TUES. 6 SEPT. 1994	112	353	THUR. 7 SEPT. 2051
42	353	SAT. 24 SEPT. 1881	99	355	MON. 26 SEPT. 1938	56	355	MON. 25 SEPT. 1995	113	354	TUES. 24 SEPT. 2052
43	354	THUR. 12 SEPT. 1882	100	353	THUR. 14 SEPT. 1939	57	353	SAT. 14 SEPT. 1996	114	355	SAT. 13 SEPT. 2053
44	355	TUES. 2 OCT. 1883	101	354	THUR. 2 OCT. 1940	58	354	THUR. 2 OCT. 1997	115	353	SAT. 3 OCT. 2054
45	353	SAT. 20 SEPT. 1884	102	355	THUR. 22 SEPT. 1941	59	355	MON. 21 SEPT. 1998	116	354	THUR. 23 SEPT. 2055
46	354	THUR. 10 SEPT. 1885	103	354	SAT. 12 SEPT. 1942	60	353	SAT. 11 SEPT. 1999	117	355	MON. 11 SEPT. 2056
47	355	THUR. 30 SEPT. 1886	104	353	THUR. 30 SEPT. 1943	61	355	SAT. 30 SEPT. 2000	118	353	SAT. 29 SEPT. 2057
48	353	MON. 19 SEPT. 1887	105	355	MON. 18 SEPT. 1944	62	354	TUES. 18 SEPT. 2001	119	354	THUR. 19 SEPT. 2058
49	354	THUR. 6 SEPT. 1888	106	353	SAT. 8 SEPT. 1945	63	355	SAT. 7 SEPT. 2002	120	355	MON. 8 SEPT. 2059
50	355	THUR. 26 SEPT. 1889	107	354	THUR. 26 SEPT. 1946	64	354	SAT. 27 SEPT. 2003	121	353	SAT. 27 SEPT. 2060
51	353	MON. 15 SEPT. 1890	108	355	MON. 15 SEPT. 1947	65	355	THUR. 16 SEPT. 2004	122	354	THUR. 15 SEPT. 2061
52	354	SAT. 3 OCT. 1891	109	353	MON. 4 OCT. 1948	66	354	TUES. 4 OCT. 2005	123	355	THUR. 5 OCT. 2062
53	355	THUR. 22 SEPT. 1892	110	354	SAT. 24 SEPT. 1949	67	353	SAT. 23 SEPT. 2006	124	353	MON. 24 SEPT. 2063
54	353	MON. 11 SEPT. 1893	111	355	TUES. 12 SEPT. 1950	68	355	THUR. 13 SEPT. 2007	125	355	THUR. 11 SEPT. 2064
55	354	MON. 1 OCT. 1894	112	353	SAT. 1 OCT. 1951	69	354	TUES. 30 SEPT. 2008	126	354	THUR. 1 OCT. 2065
56	355	THUR. 19 SEPT. 1895	113	354	SAT. 20 SEPT. 1952	70	353	SAT. 19 SEPT. 2009	127	355	SAT. 20 SEPT. 2066
57	353	SAT. 8 SEPT. 1896	114	355	THUR. 11 SEPT. 1953	71	354	THUR. 9 SEPT. 2010	128	354	SAT. 10 SEPT. 2067
58	354	SAT. 28 SEPT. 1897	115	354	TUES. 28 SEPT. 1954	72	355	THUR. 29 SEPT. 2011	129	355	THUR. 27 SEPT. 2068
59	355	THUR. 17 SEPT. 1898	116	353	SAT. 17 SEPT. 1955	73	353	MON. 17 SEPT. 2012	130	355	MON. 16 SEPT. 2069
60	353	TUES. 5 SEPT. 1899	117	355	THUR. 6 SEPT. 1956	74	355	MON. 5 SEPT. 2013	131	353	SAT. 6 SEPT. 2070
61	354	SAT. 24 SEPT. 1900	118	354	THUR. 26 SEPT. 1957	75	354	THUR. 25 SEPT. 2014	132	355	THUR. 24 SEPT. 2071
62	353	SAT. 14 SEPT. 1901	119	353	MON. 15 SEPT. 1958	76	355	MON. 14 SEPT. 2015	133	354	TUES. 13 SEPT. 2072

NOTE: CONTINUED FROM ACCOUNT STATE SHEET FOR THE YEAR 2024.





RETURN TO the circulation desk of any  
University of California Library  
or to the

NORTHERN REGIONAL LIBRARY FACILITY  
Bldg. 400, Richmond Field Station  
University of California  
Richmond, CA 94804-4698

---

ALL BOOKS MAY BE RECALLED AFTER 7 DAYS  
2-month loans may be renewed by calling

(415) 642-6233

1-year loans may be recharged by bringing books  
to NRLF

Renewals and recharges may be made 4 days  
prior to due date

---

DUE AS STAMPED BELOW

---

**^UG 21 1989**

---

**RECEIVED BY**

---

**JUL 23 1989**

---

**CIRCULATION DEPT.**

---

---

---

---

---

---

---

---

---

---

YC 15460

69509

UNIVERSITY OF CALIFORNIA LIBRARY



